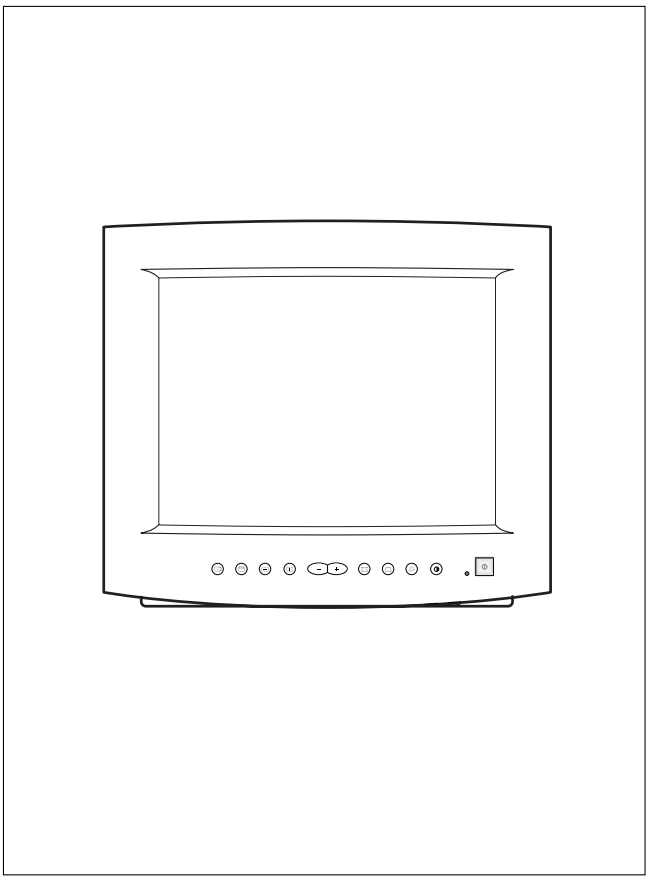
SAMSUNG

COLOR MONITOR

CHA4217L
CHA4227L
CHA5807L
CHA5227L

SERVICE Manual

COLOR MONITOR



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1 Precautions

1-1 Safety Precautions

WARNINGS

1. For continued safety, do not attempt to modify the circuit board.
2. Disconnect the AC power before servicing.
3. When the chassis is operating, semiconductor heatsinks are potential shock hazards.

1-1-1 Servicing the High Voltage VR and CRT :

WARNING: Damaged IC202 may cause excessive x-ray emissions.

1. When servicing the high voltage system, remove the static charge by connecting a 10 kohm resistor in series with an insulated wire (such as a test probe) between the chassis and the anode lead.
2. If the HV VR requires adjustment:
   This monitor does not need to adjust high voltage, high voltage step is saved at IC202, adjusting this high voltage to 24.5±0.5 kV - 14", 25.0±0.5 kV - 15".
3. When troubleshooting a monitor with excessively HV, avoid being unnecessarily close to the monitor. Do not operate the monitor for longer than is necessary to locate the cause of excessive voltage.
4. High voltage should always be kept at the rated value, no higher. Only when high voltage is excessive are X-rays capable of penetrating the shell of the CRT, including the lead in glass material. Operation at high voltages may also cause failure of the CRT or high voltage circuitry.
5. When the HV regulator is operating properly, there is no possibility of an X-ray problem. Make sure the HV does not exceed its specified value and that it is regulating correctly.
6. The CRT is especially designed to prohibit X-ray emissions. To ensure continued X-ray protection, replace the CRT only with one that is the same or equivalent type as the original.
7. Handle the CRT only when wearing shatterproof goggles and after completely discharging the high voltage anode.
8. Do not lift the CRT by the neck.

1-1-2 Fire and Shock Hazard :

Before returning the monitor to the user, perform the following safety checks:

1. Inspect each lead dress to make certain that the leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the monitor.
2. Inspect all protective devices such as nonmetallic control knobs, insulating materials, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacitor networks, mechanical insulators, etc.
3. Leakage Current Hot Check (Figure 1-1):
   WARNING: Do not use an isolation transformer during this test.
   Use a leakage current tester or a metering system that complies with American National Standards Institute (*ANSI C101.1, Leakage Current for Appliances*), and Underwriters Laboratories (*UL Publication UL1410, 59.7*).
4. With the unit completely reassembled, plug the AC line cord directly into a 120V AC outlet. With the unit's AC switch first in the ON position and then OFF, measure the current between a known earth ground (metal water pipe, conduit, etc.) and all exposed metal parts, including: metal cabinets, screwheads and control shafts. The current measured should not exceed 0.5 milliamp. Reverse the power-plug prongs in the AC outlet and repeat the test.

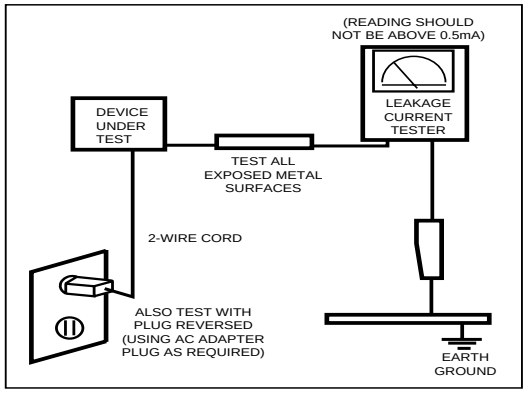

(READING SHOULD NOT BE ABOVE 0.5mA)
LEAKAGE CURRENT TESTER
DEVICE UNDER TEST
TEST ALL EXPOSED METAL SURFACES
2-WIRE CORD
ALSO TEST WITH PLUG REVERSED (USING AC ADAPTER PLUG AS REQUIRED)
EARTH GROUND

Figure 1-1. Leakage Current Test Circuit

1-1-4 Product Safety Notices

Some electrical and mechanical parts have special safety-related characteristics which are often not evident from visual inspection. The protection they give may not be obtained by replacing them with components rated for higher voltage, wattage, etc. Parts that have special safety characteristics are identified by ⚠ on schematics and parts lists. A substitute replacement that does not have the same safety characteristics as the recommended replacement part might create shock, fire and / or other hazards. Product safety is under review continuously and new instructions are issued whenever appropriate.

Components identified by ☢ on schematics and parts lists must be sealed by a soldering iron after replacement and adjustment.

1-2 Servicing Precautions

WARNING1: First read the "Safety Precautions" section of this manual. If unforeseen circumstances create conflict between the servicing precautions and safety precautions, always follow the safety precautions.

WARNING2: An electrolytic capacitor installed with the wrong polarity might explode.

1. Servicing precautions are printed on the cabinet, and should be followed closely.
2. Always unplug the unit's AC power cord from the AC power source before attempting to: (a) remove or reinstall any component or assembly, (b) disconnect PCB plugs or connectors, (c) connect all test components in parallel with an electrolytic capacitor.
3. Some components are raised above the printed circuit board for safety. An insulation tube or tape is sometimes used. The internal wiring is sometimes clamped to prevent contact with thermally hot components. Reinstall all such elements to their original position.
4. After servicing, always check that the screws, components and wiring have been correctly reinstalled. Make sure that the area around the serviced part has not been damaged.
5. Check the insulation between the blades of the AC plug and accessible conductive parts (examples: metal panels, input terminals and earphone jacks).
6. Insulation Checking Procedure: Disconnect the power cord from the AC source and turn the power switch ON. Connect an insulation resistance meter (500 V) to the blades of the AC plug.

   The insulation resistance between each blade of the AC plug and accessible conductive parts (see above) should be greater than 1 megohm.
7. Never defeat any of the +B voltage interlocks. Do not apply AC power to the unit (or any of its assemblies) unless all solid-state heat sinks are correctly installed.
8. Always connect a test instrument's ground lead to the instrument chassis ground *before* connecting the positive lead; always remove the instrument's ground lead last.

1-3 Electrostatically Sensitive Devices (ESD) Precautions

Some semiconductor (solid state) devices can be easily damaged by static electricity. Such components are commonly called Electrostatically Sensitive Devices (ESD). Examples of typical ESD devices are integrated circuits and some field-effect transistors. The following techniques will reduce the incidence of component damage caused by static electricity.

1. Immediately before handling any semiconductor components or assemblies, drain the electrostatic charge from your body by touching a known earth ground. Alternatively, wear a discharging wrist-strap device. To avoid a shock hazard, be sure to remove the wrist strap before applying power to the monitor.
2. After removing an ESD-equipped assembly, place it on a conductive surface such as aluminum foil to prevent accumulation of an electrostatic charge.
3. Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ESDs.
4. Use only a grounded-tip soldering iron to solder or desolder ESDs.
5. Use only an anti-static solder removal device. Some solder removal devices not classified as "anti-static" can generate electrical charges sufficient to damage ESDs.
6. Do not remove a replacement ESD from its protective package until you are ready to install it. Most replacement ESDs are packaged with leads that are electrically shorted together by conductive foam, aluminum foil or other conductive materials.
7. Immediately before removing the protective material from the leads of a replacement ESD, touch the protective material to the chassis or circuit assembly into which the device will be installed.

   Caution: Be sure no power is applied to the chassis or circuit and observe all other safety precautions.
8. Minimize body motions when handling unpackaged replacement ESDs. Motions such as brushing clothes together, or lifting your foot from a carpeted floor can generate enough static electricity to damage an ESD.
9. ⚠ Indicates ESDs on the Schematic Diagram in this manual.

2 Reference Information

2-1 List of Abbreviations, Symbols and Acronyms

2-1-1 Abbreviations

Abbreviation	Definition
ASS'Y	Assembly
B	Blue
B+ ADJ	B+ Adjustment
B-CUT	Blue-Cutoff
B-GAIN	Blue Gain
BRIGHT	Brightness
C	R-Composition
C-MIC	Condenser Microphone
CLK	Clock
CM	R-Cement
CN	Connector
CONT	Contrast
D-SUB	D-Subminiature
EEP-CLK	Electrically Erasable and Programmable Clock
EXT	External
EXT-MIC	External Microphone
Freq.	Frequency
FU	Fusible
G	Green
G-CUT	Green-Cutoff
G-GAIN	Green Gain
GND	Ground
H	Horizontal
H	Heater
H-DRV	Horizontal Drive
H-DY	Horizontal Deflection York
H-FLB	Horizontal Flyback
H-FV	Horizontal-Feedback Voltage
H-LIN	Horizontal Linearity
H-POSI	Horizontal Position
H-SIZE	Horizontal Size
H/PHONE	Headphone
Hz	Hertz
I-SENSE	Current-Sense
Ib	Pound
MAX	Maximum
MIC	Microphone
MIN	Minimum
MP	C-Metalized Polyester
MPP	Metal Polypropylene
MO	R-Metal Oxide

Abbreviation	Definition
OSC	Oscillator
P	C-Polyester
PARA	Parabola
PARALL	Parallelogram
PIN-BAL	Pincushion Balance
PRE-AMP	Pre-Amplifier
PS1	Power Saving1 (suspend)
PS2	Power Saving2 (off)
PWR	Power
R	Red
R-CUT	Red-Cutoff
R-GAIN	Red Gain
RST	Reset
S-PIN	Side Pincushion
S-RASTER	Self Raster
S/W	Switch
SCAP	S Correction Capacitor
SPK	Speaker
SYNC	Synchronization
T	C-Tantalum
TR	Transistor
TRAP	Trapezoid
U-COM	Microprocessor
V	Vertical
V-DY	Vertical Deflection York
V-FLB	Vertical Flyback
V-LIN	Vertical Linearity
V-MUTE	Video Mute
V-OUT	Vertical Output
V-PARA	Vertical Parabola
V-POL	V-Polarity
V-POSI	Vertical Position
V-SENSE	Voltage-Sense
V-SIZE	Vertical Size
WW	R-Wire Wound
X-TAL	Crystal
Ω	ohm
KΩ	1000 ohm
MΩ	1000 KΩ
uF	microfarad (10^{-6}F)
nF	nanofarad (10^{-9}F)
pF	picofarad (10^{-12}F)

2-1-2 Symbols

- Can emit X-radiation
- Hot Ground
- Cold Ground
- Electrostatically Sensitive Device (ESD)
- Provides special safety considerations

2-1-2 Acronyms

Acronym	Definition
ABL	Automatic Brightness Limits
AC	Alternating Current
ACL	Automatic Contrast Limit
AFC	Automatic Frequency Control
ANSI	American National Standards Institute
CMOS	Complementary Metal Oxide Semiconductor
CRT	Cathode Ray Tube
DC	Direct Current
DDC	Data Display Channel
DF	Dynamic Focus
DMM	Digital Multimeter
DPMS	Display Power Management Signaling
DVM	Digital Voltmeter
DY	Deflection York
EEPROM	Electrically Erasable and Programmable Read only Memory
ESD	Electrostatically Sensitive Device
ESF	Electronic Static Field
FBT	Flyback Transformer
FET	Field Effect Transistor
FH	Horizontal Frequency
FS	Fail Safe
FV	Vertical Frequency
GD	Geometric Distortion

Acronym	Definition
H/V	Horizontal/Vertical
HV	High Voltage
I/O	Input/Output
IC	Integrated Circuit
LED	Light Emitting Diode
MAC	Macintosh
MOFA	Mask Outside Frame Assemble
OCP	Over Current Protection
OP AMP	Operational Amplifier
OSD	On Screen Display
P-P	Peak to Peak
PCB	Printed Circuit Board
PLL	Phase Locked Loop
PWM	Pulse Width Modulation
SMPS	Switch Mode Power Supply
SVGA	Super Video Graphics Array
SWEDAC	
TP	Test Point
UL	Underwriters Laboratories
USB	Universal Serial Bus
VESA	Video Electronics Standard Association
VGA	Video Graphics Array
VR	Variable Registor
W/B	White Balance

3 Product Specifications

3-1 Specifications

Item	Description	
Picture Tube:	CHA42*7L: 14-Inch (36 cm); 13.2-Inch (33.5 cm) viewable, 90° Deflection, CHA5**7L: 15-Inch (38 cm); 13.8-Inch (35 cm) viewable, flat-face tube, 90° Deflection, 0.28 mm Dot pitch, Semi-tint, Non-glare, Antistatic silica coating, Invar shadow mask	
Scanning Frequency	Horizontal: 30 kHz to 55 kHz (Automatic) - 14" / 30 kHz to 61 kHz (Automatic) - 15" Vertical: 50 Hz to 125 Hz (Automatic)	
Display Colors	Unlimited colors	
Maximum Resolution	Horizontal : 1024 Dots Vertical : 768 Lines	
Input Video Signal	Analog, 0.714 Vp-p positive at 75 Ω, internally terminated	
Input Sync Signal	Separate Sync : TTL level positive/negative	
Maximum Pixel Clock	14" : 65 MHz, 15" : 85 MHz	
Active Display	14"	15"
Horizontal Vertical	255 mm ± 3 mm (4:3 ratio) 191 mm ± 3 mm	267 mm ± 3 mm (4:3 ratio) 200 mm ± 3 mm
Input Voltage	AC 90 to 264 Volts, 60 Hz/50 Hz ± 3 Hz	
Power Consumption	73 Watt	
Dimensions	14"	15"
Unit (W x D x H) Carton (W x D x H)	13.7 x 15.2 x 14.3 Inches (348 x 385 x 362.5 mm) 16.6 x 18.1 x 15.4 Inches (422 x 460 x 390 mm)	14.6 x 15.6 x 14.8 Inches (370 x 395 x 377 mm) 17.9 x 19.6 x 17.0 Inches (454 x 497 x 433 mm)
Weight (Net/Gross)	CHA42*7L : 23.1 lbs (10.5 kg) / 27.3 lbs (12.4 kg) CHA5**7L : 27.6 lbs (12.5 kg) / 30.9 lbs (14.0 kg)	
Environmental Considerations	Operating Temperature : 32°F to 104°F (0°C to 40°C) Humidity : 10 % to 80 % Storage Temperature : -4°F to 113°F (-20°C to 45°C) Humidity : 5 % to 95 %	
CRT Code No.		

- CHA42*7L/5**7L complies with SWEDAC (MPR II) recommendations for reduced electromagnetic fields.
- Designs and specifications are subject to change without prior notice.

3-2 Pin Assignments

Sync Type / Pin No.	15-Pin Signal Cable Connector (Figure 3-1)
	Separate
1	Red
2	Green
3	Blue
4	GND
5	DDC Return
6	GND-R
7	GND-G
8	GND-B
9	Reserved
10	GND-Sync/Self-raster
11	GND
12	DDC Data
13	H-Sync
14	V-Sync
15	DDC Clock

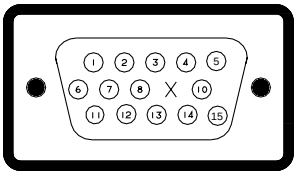


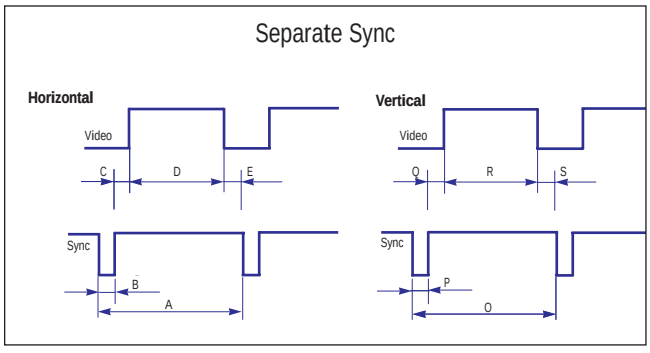
Figure 3-1. Male Type

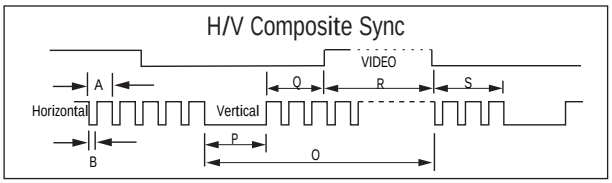
3-3 Timing Chart

This section of the service manual describes the timing that the computer industry recognizes as standard for computer-generated video signals.

Table 3-1. Timing Chart

Mode / Timing	IBM		VESA					
	720/70 Hz 720 x 400	640/60 Hz 640 x 480	640/75 Hz 640 x 480	640/85 Hz 640 x 480	800/75 Hz 800 x 600	800/85 Hz 800 x 600	1024/60 Hz 1024 x 768 (14")	1024/75 Hz 1024 x 768 (15")
fH (kHz)	31.469	31.469	37.500	43.269	46.875	53.674	48.363	60.023
A µsec	31.777	31.778	26.667	23.111	21.333	18.631	20.677	16.660
B µsec	3.813	3.813	2.032	1.556	1.616	1.138	2.092	13.003
C µsec	1.907	1.907	3.810	2.222	3.232	2.702	2.462	3.658
D µsec	25.422	25.422	20.317	17.778	16.162	14.222	15.754	13.206
E µsec	0.636	0.636	0.508	1.556	0.323	0.569	0.369	3.454
fV (Hz)	70.087	59.940	75.000	85.008	75.000	85.061	60.004	75.029
O msec	14.268	16.683	13.333	11.764	13.333	11.756	16.666	13.328
P msec	0.064	0.064	0.080	0.069	0.064	0.056	0.124	12.795
Q msec	1.080	1.048	0.427	0.578	0.448	0.503	0.600	0.533
R msec	12.711	15.253	12.800	11.093	12.800	11.179	15.880	12.812
S msec	0.413	0.318	0.027	0.023	0.021	0.019	0.062	0.516
Clock Frequency (MHz)	28.322	25.175	31.500	36.000	49.500	56.250	65.000	78.750
Polarity H.Sync	Negative	Negative	Negative	Negative	Positive	Positive	Negative	Positive
V.Sync	Positive	Negative	Negative	Negative	Positive	Positive	Negative	Positive
Remark	Separate	Separate	Separate	Separate	Separate	Separate	Separate	Separate



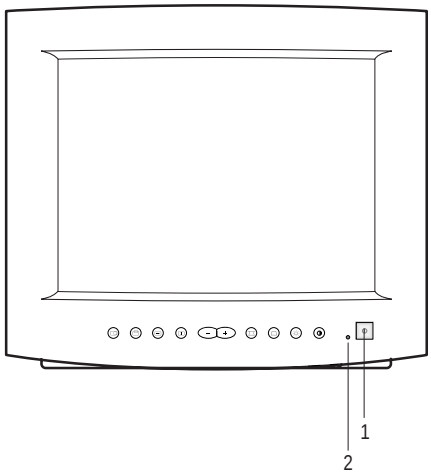


A : Line time total	B : Horizontal sync width	O : Frame time total	P : Vertical sync width
C : Back porch	D : Active time	Q : Back porch	R : Active time
E : Front porch		S : Front porch	

Memo

4 Operating Instructions

4-1 Front View and Control



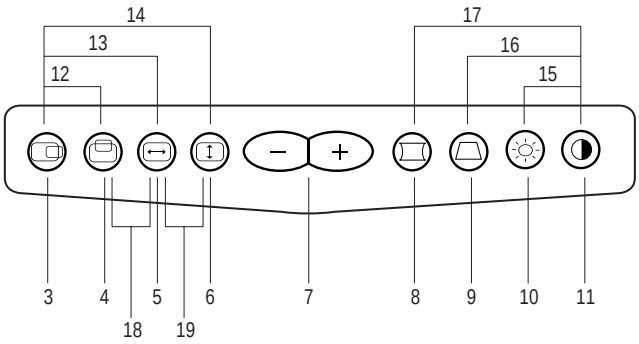


Figure 4-1. Front Control Panel

Table 4-1. Front Panel Controls

Location	Symbol	Description
1		Power Button
2		Power Indicator LED
3		Horizontal Position Button
4		Vertical Position Button
5		Horizontal Size Button
6		Vertical Size Button
7		Adjustment Buttons
8		Side Pincushion Button
9		Trapezoid Button
10		Brightness Control
11		Contrast Control
12	+	Parallelogram
13	+	V-Linearity
14	+	Pinbalance Button
15	+	Degauss
16	+	Recall
17	+	User Delete
18	+	Tilt (Option: 15”)
19	+	V-Moire

Note 1: This monitor requires a cable adapter for use with a Macintosh computer. The MacMaster Cable Adapter supports all monitors and all Macintosh, Centris, Quadra, Duo Dock, and Power Macintosh computers. If you do not already have a cable adapter, check with your computer dealer.

Note 2: When used with a computer equipped with VESA DPMS functions, this monitor is EPA Energy Star compliant and NUTEK compliant.

Table 4-2. Display Power Management Signaling (DPMS)

State / Items	Normal Operation	Power saving function EPA/NUTEK		
		Stand-By Mode	Suspend Mode Position A	Power Off Mode Position B
Horizontal Sync	Active	Inactive	Active	Inactive
Vertical Sync	Active	Active	Inactive	Inactive
Video	Active	Blanked	Blanked	Blanked
Power Indicator	Green	Green Blinking (0.5 sec interval)	Green Blinking (0.5 sec interval)	Green Blinking (1 sec interval)
Power Consumption/hr	73 W (max.) 60 W (nominal)	50 W (nominal)	Less than 15 W	Less than 5 W

5 Disassembly and Reassembly

This section of the service manual describes the disassembly and reassembly procedures for the CHA42*7L/5**7L monitors.

WARNING: This monitor contains electrostatically sensitive devices. Use caution when handling these components.

5-1 Disassembly

Cautions: 1. Disconnect the monitor from the power source before disassembly.
2. Follow these directions carefully; never use metal instruments to pry apart the cabinet.

5-1-1 Cabinet Disassembly

1. With a pad beneath it, stand the monitor on its front with the screen facing downward and the base closest to you. Make sure nothing will damage the screen.
2. Working from the back of the monitor, remove the four screws and remove the Rear Cover.
3. Using pinch-nose pliers or long-nose pliers, carefully disconnect the Anode Cap from the CRT.

Caution: Do not touch the anode contact on the CRT.

5-1-2 Removing the CRT Socket PCB

1. Complete all previous steps.
2. Disconnect CRT and Main PCB ground wires on CRT Socket PCB and Shield Cover.
3. Desolder the 5 tabs on the underside of the CRT Socket PCB shield and remove the CRT Socket PCB Shield.
4. Using a knife, cut through the silicone bond and lift off the CRT Socket PCB.
5. Disconnect connectors CN102 and CN103 on the CRT Socket PCB.
6. Using a solder iron, disconnect CN202_2.
7. Disconnect CRT Socket and Focus (G3) wires on CRT Socket PCB.
8. Place Video PCB on a flat, level surface that is protected from static electricity.

5-1-3 Removing the Main PCB

1. Complete all previous steps.
2. Disconnect Degaussing Coil at the CN601 connector on the Main PCB.
3. Disconnect all easily accessible ground wires on the Main PCB and Chassis Bottom.
4. Disconnect the DY connector between the DY and the CN301, CN302, CN502 and CN503 connector on the Main PCB.
5. Remove the screws on the back and along each side of the Chassis Bottom.
6. Carefully lift the Main PCB Ass'y.
7. Remove all other ground wires.

5-1-4 CRT Ass'y Disassembly

1. Complete all previous steps.
2. Straighten the Degaussing Coil Assembly coated metal ties and lift Coil Ass'y from the CRT.
3. Remove the four corner screws and lift the CRT up and away from the Front Cover Assembly and place it on a padded surface.

Caution: Do not lift the CRT by the neck.
If you will be returning this CRT to the monitor, be sure to place the CRT face downward on a protective pad.

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6 Alignment and Adjustments

This section of the service manual explains how to make permanent adjustments to the monitor. Directions are given for adjustments using the monitor Interface Board Ver. 2.0 and software (SoftJig).

6-1 Adjustment Conditions

Caution: Changes made without the SoftJig are saved only to the user mode settings. As such, the settings are not permanently stored and may be inadvertently deleted by the user.

6-1-1 Before Making Adjustments

6-1-1 (a) ORIENTATION

When servicing, always face the monitor to the east.

6-1-1 (b) MAGNETIC FIELDS

Whenever possible, use magnetic field isolation equipment such as a Helmholtz field to surround the monitor. If a Helmholtz field is not available, frequently degauss the unit under test.

Caution: Other electrical equipment may cause external magnetic fields which may interfere with monitor performance.

Use an external degaussing coil to limit magnetic build up on the monitor. If an external degaussing coil is not available, use the internal degaussing circuit. However, do not use the internal degaussing circuit more than once per 30 minutes.

6-1-1 (c) WARM-UP TIME

The monitor must be on for 30 minutes before starting alignment procedures. Warm-up time is especially critical in Color Temperature and White Balance adjustments.

6-1-1 (d) SIGNAL

Analog, 0.714 Vp-p positive at 75 ohm, internal termination
Sync: Separate
(TTL level negative/positive)

6-1-1 (e) SCANNING FREQUENCY

Horizontal:	30 kHz to 55 kHz (automatic)-14″
	30 kHz to 61 kHz (automatic)-15″
Vertical:	50 Hz to 120 Hz (automatic)

Unless otherwise specified, adjust at the 800 x 600 mode (H : 53.7 kHz, V: 85 Hz)-15″, the 640 x 480 mode (H : 43.8 kHz, V: 85 Hz)-14″ signals.

Refer to Table on page 3-3.

6-1-1 (f) +B 13 V LINE CHECK

No beam
Contrast: Maximum
Brightness: Maximum

Check the DC 13 V ± 0.2 V at Cathode of D616 Point and GND.

6-1-1 (g) HIGH VOLTAGE CHECK

No beam
Contrast: Maximum
Brightness: Maximum

Check the high voltage to 24.5 ± 0.5 kV - 14″, 25 ± 0.5 kV - 15″ at anode and GND.

6-1-1 (i) CENTER RASTER

Adjust VR502 so that the back raster comes to the center when you apply a signal of 53.7 kHz/ 85 Hz - 14″, 60 kHz/75 Hz - 15″ .

6-1-1 (j) BRIGHTNESS AND CONTRAST

Unless otherwise specified, adjust brightness and contrast buttons:

Brightness:	Maximum
	(press ⊕ button until the LED is blink)
Contrast:	Maximum
	(press ⊕ button until the LED is blink)

6-1-2 Required Equipment

The following equipment may be necessary for adjustment procedures:

6-1-2 (a) DISPLAY CONTROL ADJUSTMENT

1. Non-metallic (–) screwdriver: 1.5 mm
   Non-metallic (–) screwdriver: 3 mm
2. Philips (+) screwdriver: 1.5 mm
3. Non-metallic hexkey: 2.5 mm
4. Digital Multimeter (DMM), or
   Digital Voltmeter (DVM)
5. Signal generator, or
   Computer with a video board that uses the ET-4000 chipset (strongly recommended if using Samsung DM 200 software) and that displays: 800 x 600 @ 85 Hz, or 800 x 600 @ 75 Hz (minimum).
6. Personal computer
7. Required software: Softjig.exe from Samsung, Samsung DM200, or DisplayMate for Windows from Sonera Technologies
8. Interface Board Ver. 2.0 Code No. BH81-90001K
9. Parallel communications cable (25-pin to 25-pin); Code No. BH81-90001H
10. Signal cable (15-pin to 15-pin cable with additional 3-pin connector); Code No. BH81-90001J
11. 5 V DC adapter, not supplied

Note: SoftJig Assembly (includes items 8, 9 and 10 Code No. BH81-90001L

6-1-2 (b) COLOR ADJUSTMENTS

1. All equipment listed in 6-1-2 (a), above
2. Color analyzer, or any luminance measurement equipment

6-1-3 Connecting the SoftJig

Connect the monitor to the signal generator and/or PC as illustrated in Figures 6-1 and 6-2.

Note: The signal cable connector which includes the 3-wire cable must connect to the monitor. If you use Setup 2 (PC only, no signal generator) you can only make adjustments to the signal timing available on that computer system. To make corrections to all factory timings requires the use of an additional signal generator.

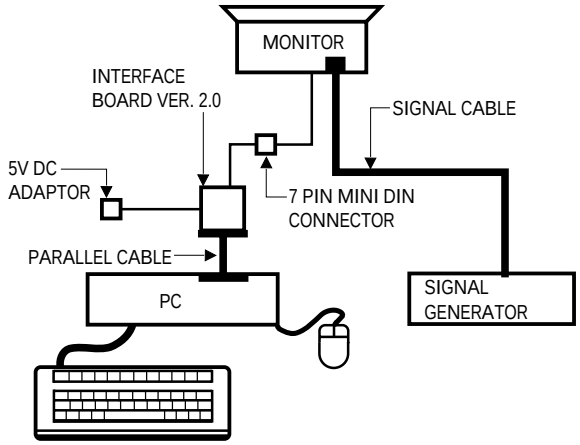


Figure 6-1. Setup 1, With Signal Generator

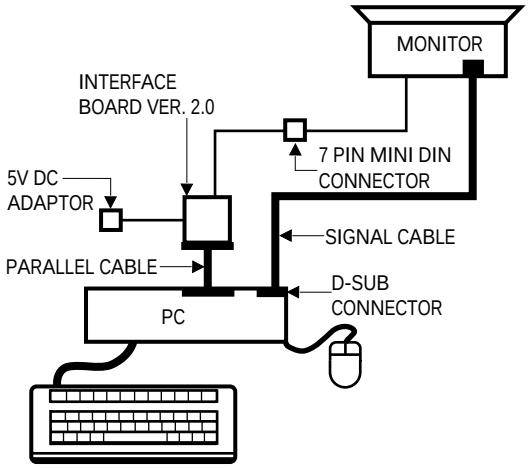


Figure 6-2. Setup 2, Without Signal Generator

6-1-4 After Making Adjustments

After finishing all adjustments, test the monitor in all directions. If, for example, the monitor does not meet adjustment specifications when facing north, reposition the monitor to face east and readjust. This time, try for an adjustment closer to the ideal setting within the tolerance range. Test the unit again in all directions. If the monitor again fails to meet specifications in every direction, contact your Regional After Service Center for possible CRT replacement.

6-2 Display Control Adjustments

6-2-1 Centering

Centering means to position the center point of the display in the middle of the display area. Horizontal size and position and vertical size and position control the centering of the display.

Adjust the horizontal size and vertical size to their optimal settings: 267 mm (H) x 200 mm (V) for 15″, 255 mm (H) x 191 mm (V) for 14″

Adjust the horizontal position and vertical position to within 4.0 mm of the center point of the screen.

l A - B l ≤ 5.0 mm.
l C - D l ≤ 5.0 mm.

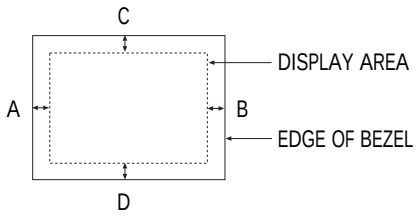


Figure 6-3. Centering

6-2-1 (a) HORIZONTAL MINIMUM SIZE ADJUSTMENT

CONDITIONS

Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Crosshatch pattern
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

Horizontal minimum size can be adjusted as follows using Softjig.

1. Display the timing 800 x 600/85 Hz (15″), 640 x 480/85 Hz (14″).
2. Adjust horizontal size to minimum size using H_SIZE.
3. Adjust horizontal minimum size to 250 mm (15″) or 242 mm (14″) using H_SIZE MIN.
4. Adjust horizontal size to 267 mm (15″) or 255 mm (14″) using H_SIZE.
5. Press the ALL MODE SAVE horizontal minimum size for each timing is saved automatically.

If horizontal minimum size range cannot meet the spec, horiontal maximum size of 640 x 480/75 Hz including 800 x 600/60 Hz, 56 Hz, may be saturated or cannot overscan the bezel.

6-2-1 (b) VERTICAL SIZE ADJUSTMENT

CONDITIONS

Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Crosshatch pattern
Brightness:	Maximum
Contrast:	Maximum

Adjust the vertical size of the display pattern to 200 mm (15″) and 191 mm (14″).
(Tolerance: ± 3 mm.)

6-2-1 (c) HORIZONTAL POSITION ADJUSTMENT

CONDITIONS

Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Crosshatch pattern

PROCEDURE

Center the test pattern on the raster.

6-2-1 (d) VERTICAL POSITION ADJUSTMENT

CONDITIONS

Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Crosshatch pattern

Center the test pattern on the raster.

6-2-2 Linearity

Linearity affects the symmetry of images as they appear on the screen. Unless each row or column of blocks in a crosshatch pattern is of equal size, or within the tolerances shown in Tables 6-1 and 6-2, an image appears distorted, elongated or squashed.

The formular of linearity (%)

$$= \frac{2 \times (Max - Min)}{Max + Min} \times 100$$

Table 6-1. Standard Modes Linearity: 800 x 600/85Hz - 15″ 640 x 480/85 Hz - 14″

	Standard Timing Modes	
	Each block (10 %)	Difference between adjacent blocks (4 %)

Table 6-2. Other Modes Linearity: VGA, SVGA, XGA, MAC, etc.

	Supported Timing Mode	
	Each block (14 %)	Difference between adjacent blocks (5 %)

6-2-3 Trapezoid Adjustment

CONDITIONS

Scanning frequency: 53.7 kHz/85 Hz (15″)
43.3 kHz/85 Hz (14″)
Display image: Crosshatch pattern

Make the the test pattern rectangular.

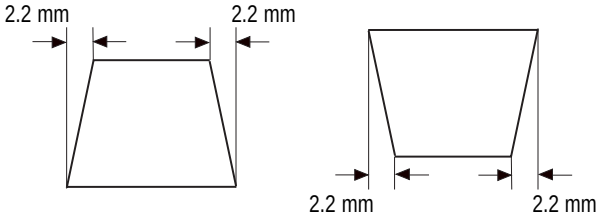


Figure 6-4. Trapezoid

6-2-4 Parallelogram Adjustment

CONDITIONS

Scanning frequency: 53.7 kHz/85 Hz (15″)
43.3 kHz/85 Hz (14″)
Display image: Crosshatch pattern

To activate the Parallelogram Adjustment function, push both the Horizontal Position and Vertical Position buttons and hold them in for longer than 3 seconds, or until the power indicator LED changes from green to blink and back to green.

Use the Increase (+) and Decrease (–) buttons to correct the display shape.

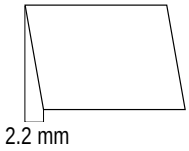


Figure 6-5. Parallelogram

6-2-5 Side Pincushion Adjustment

CONDITIONS

Scanning frequency: 53.7 kHz/85 Hz (15″)
43.3 kHz/85 Hz (14″)
Display image: Crosshatch pattern

After pushing the Side Pincushion button once, push the Increase (+) and Decrease (–) buttons to straighten the sides of the test pattern.

$|C1|, |C2| \leq 2.0$ mm, $|D1|, |D2| \leq 2.2$ mm.

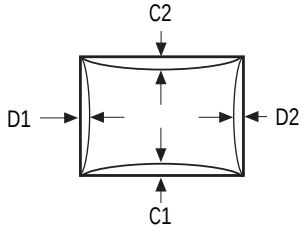


Figure 6-6. Pincushion

6-2-6 CRT Tilt Adjustment

TILT ADJUSTMENT (CHA5807L With Tilt)

Push the V-Posi and H-Size simultaneously until Led blinks and back on again. Push the Increase (+) and Decrease (–) buttons to correct the Tilt.

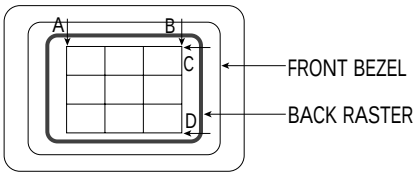


Figure 6-7. CRT Tilt Adjustment

6-2-7 Vertical Linearity Adjustment

To activate the vertical linearity adjustment, push both the horizontal position and horizontal size buttons and hold then in for longer than 3 seconds, or until the power indicator LED changes from green to blink and back to green.

Use the Increase (+) and Decrease (–) buttons to correct the display shape.

6-2-8 Pin Balance Adjustments

To activate the pin balacne function, push both the horizontal position and vertical Size buttons and hold then in for longer than 3 seconds, or until the power indicator LED changes from green to blink and back to green.

Use the Increase (+) and Decrease (–) buttons to correct the display shape.

6-2-9 Degauss

Push the contrast and brightness buttons simultaneously. The degaussing circuit can effectively function only once per 30 minutes. If available, use an external degaussing coil during servicing.

6-2-10 Delete User Mode Data

To delete the picture data from the user modes, push the contrast button and side pincushion button for 5 or more seconds simultaneously.

6-2-11 Recall

To delete the picture data from current user mode, push the contrast button and trapzoid button for 5 or more seconds simultaneoulsy.

6-3 Color Adjustments

Note 1: Color adjustment of this mode is controled by Micom Jig or software.

Note 2: To make color adjustments you must have a color analyzer and one of the following configurations:

1. Signal Generator
   or
2. Computer with Samsung DM 200 software or DisplayMate for Windows software from Sonera Technologies
3. In case of CHA5**7L, use 800 x 600 mode signal (53.7 kHz/85 Hz) for adjustments, in case of CHA42*7L, use 640 x 480 mode signal (43.3 kHz/85 Hz).

Before making adjustments, check that the video signals are as follows:

Video : Analog, 0.714 Vp-p (at 75 Ω termination)
Sync : Separate TTL level
Unless otherwise specified, use 800 x 600 mode signal (53.7 kHz/85 Hz) for adjustments.

6-3-1 Color Coordinates (Temperature)

Color temperature is a measurement of the radiant energy transmitted by a color. For computer monitors, the color temperature refers to the radiant energy transmitted by white. Color coordinates are the X and Y coordinates on the chromaticity diagram of wavelengths for the visible spectrum.

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	White flat field at center of display area
Luminance:	Maximum

PROCEDURE

Using the directions in sections 6-3-2 through 6-3-5, adjust the Color Coordinates for 9300K to x = 0.283 ± 0.02 and y = 0.298 ± 0.02

6-3-2 Back Raster Color Adjustment

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Back raster pattern
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

1. Adjust the Screen VR on the FBT so that the brightness of the Back Raster is 0.3 to 0.5 ft-L (typically 0.4 ft-L).
2. Adjust the G_CUT to center.
3. Adjust the B_CUT to set the "y" coordinate to 0.298 ± 0.02.
4. Adjust the R_CUT to set the "x" coordinate to 0.283 ± 0.02.

Note: If the above adjustments cannot be done to each coordinate, adjust G_CUT to increase or decrease the green cutoff and repeat procedures 3 and 4.

6-3-3 Video Gain Adjustment

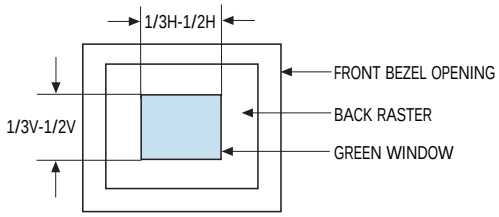


Figure 6-8. Green Box Pattern

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	Green box pattern within range for which the ABL circuit is not active (1/3 to 1/2H and 1/3 to 1/2V).
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

1. Adjust G-Gain so that the brightness of the green gain is 40 ± 1 ft-L (typically 40 ft-L).

6-3-4 White Balance Adjustment

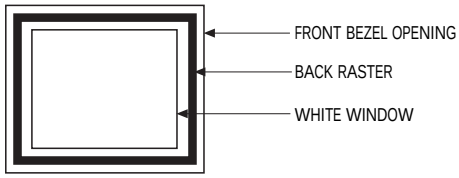


Figure 6-9. Full White Pattern

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″)
	43.3 kHz/85 Hz (14″)
Display image:	Full white pattern
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

1. Display the full white pattern.
2. Adjust R-Gain and B-Gain so that the video is white.
   (x = 0.283 ± 0.02 and y = 0.298 ± 0.02)

6-3-5 White Balance Fine Adjustment

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″)
	43.3 kHz/85 Hz (14″)
Display image:	Full white pattern
X-Y coordinates:	x = 0.283 ± 0.02
	y = 0.298 ± 0.02

PROCEDURE

1. Adjust the Contrast control so that the brightness of the video is about 5 ft-L.
2. Check whether the white coordinates of the video meet the specification above. If they do not, adjust them so that they do.
3. Adjust the Contrast to maximum luminance.
4. Check whether the white coordinates still meet the specification above. If they do not, adjust them so that they do.

6-3-6 ABL Point Adjustment

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″)
	43.3 kHz/85 Hz (14″)
Display image:	Full white pattern
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

Adjust ABL so that the brightness level is 35 ± 1 ft-L.

6-3-7 Focus Adjustment

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″)
	43.3 kHz/85 Hz (14″)
Display image:	“H” character pattern
Brightness:	Maximum
Contrast:	Maximum

PROCEDURE

1. Adjust the Focus VR on the FBT to display the sharpest image possible.
2. Use Locktite to seal the Focus VR in position.

6-3-8 Luminance Uniformity Check

CONDITIONS

Measurement instrument:	Color analyzer
Scanning frequency:	53.7 kHz/85 Hz (15″)
	43.3 kHz/85 Hz (14″)
Display image:	White flat field
Brightness:	Cut off point at 30 ft-L

PROCEDURE

Measure luminance at nine points on the display screen: top left corner, top center, top right corner, center row left side, center, center row right side, bottom left corner, bottom center, and bottom right corner.

6-3-9 Color Purity Adjustment

Color purity is the absence of undesired color. Conspicuous mislanding (unexpected color in a uniform field) within the display area shall not be visible at a distance of 50 cm from the CRT surface.

CONDITIONS

Orientation:	Monitor facing east
Scanning frequency:	53.7 kHz/85 Hz (15″) 43.3 kHz/85 Hz (14″)
Display image:	White flat field
Luminance:	Cutoff point at the center of the display area

Caution: Color purity adjustments should only be attempted by qualified personnel.

PROCEDURE

For trained and experienced service technicians only.

Use the following procedure to correct minor color purity problems:

1. Make sure the display is not affected by external magnetic fields. Use an external degaussing coil to neutralize magnetic fields which may be affecting color purity.
2. Very carefully break the glue seal between the 2-pole purity convergence magnets (PCM), the band and the spacer (see Figure 6-9).
3. Make sure the spacing between the PCM assembly and the CRT stem is 22.5 mm ± 1 mm.
4. Display a red pattern over the entire display area.
5. Adjust the Purity Magnet Rings on the PCM assembly to display a pure green pattern. (Optimal setting: x = x = 0.310 ± 0.015, y = 0.592 ± 0.015)
6. Repeat steps 4 and 5 using a red pattern and then again, using a blue pattern.

Table 6-3. Color Purity Tolerances

Red:	x = 0.625 ± 0.015	y = 0.340 ± 0.015
Green:	x = 0.310 ± 0.015	y = 0.592 ± 0.015
Blue:	x = 0.150 ± 0.015	y = 0.063 ± 0.015

(For 9300K white color adjustment: x = 0.283 ± 0.02, y = 0.298 ± 0.02)

7. When you have the PCMs properly adjusted, carefully gule them together with Locktite to prevent their movement during shipping.

6-4 Convergence Adjustments

Misconvergence occurs when one or more of the electron beams in a multibeam CRT fail to meet the other beams at a specified point.

Table 6-4. Misconvergence Tolerances

Position	Error in mm	CRT Dot Pitch
Center (A)	0.30	0.28
Edge (B)	0.40	0.28

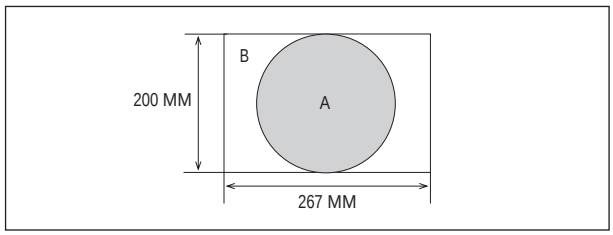
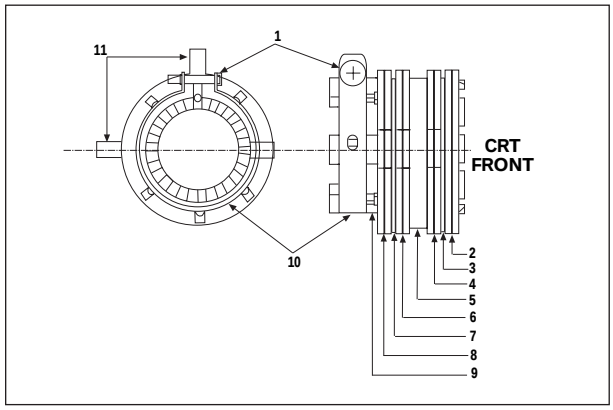


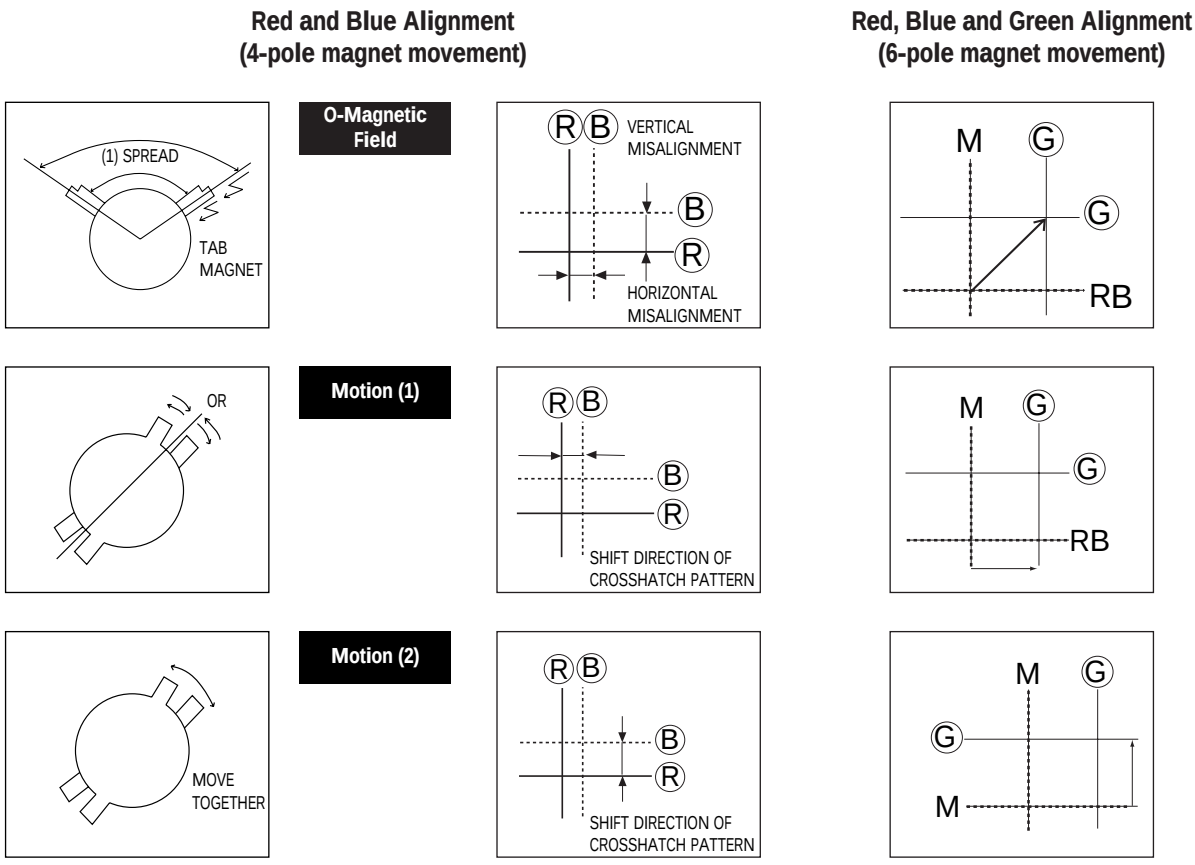
Figure 6-10. Convergence Measurement Areas



Toshiba CRT			
1 Setup Bolt	2 Bow Magnet	3 Spacer	4 2-Pole Magnet
5 Band	6 6-Pole Magnet	7 Spacer	8 4-Pole Magnet
9 Holder	10 Band	11 Tabs	

Figure 6-11. Magnet Configuration

Figure 6-12. Magnet Movements



6-4-1 Static (Center) Convergence

Static convergence involves alignment of the red, blue and green lines in the center area of the display.
See "Dynamic Convergence" for alignment of color fields around the edges of the display.

CONDITIONS

Direction: Monitor facing east
Warm-up: 30 minutes
Display image: Crosshatch pattern
Tolerances: See Table 6-5

PROCEDURE

As shown in Figure 6-11, the CRT used in this monitor has the magnet configuration as shown in Table 6-6.

Table 6-5. Magnet Configurations

CRT Manufacturer	Magnet Order from Front of CRT
Toshiba	Convergence bow, 2-pole, 6-pole, 4-pole

Use the following steps to correct any static misconvergence:

1. Locate the pair of 4-pole magnet rings.
2. Unlock the rings and rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue lines.
3. Rotate the pair of rings (maintaining spacing between tabs) to converge the horizontal red and blue lines.
4. After completing the red and blue center convergence adjustment, locate the pair of 6-pole magnet rings.
5. Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue (magenta) and green lines.
6. Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue (magenta) and green lines. Don't rotate the 2-pole magnets as they adjust for color purity.
7. Mark the correct position for the magnets and apply a small line of glue to hold the magnets in place. Lock the rings in place.

6-4-2 Dynamic (Edge) Convergence

CONDITIONS

Direction: Monitor facing east
Warm-up: 30 minutes
Display image: Crosshatch pattern
Tolerances: See Table 6-5

PROCEDURE

Use the following procedure to correct minor dynamic (edge) misconvergence. If, after using this procedure, dynamic misconvergence is still greater than the tolerance around the periphery of the display area, contact the Regional After Service Center for possible CRT replacement.

1. Make sure the display is not affected by external magnetic fields.
2. Make sure the static convergence is properly adjusted.
3. Strategically place small magnet rubbers on the back of the CRT to correct the misconvergence. Be careful not to remove the paper protecting the adhesive on the magnet rubbers until you are satisfied with their placement and the dynamic convergence.
4. When you are satisfied with the convergence around the edge of the CRT, permanently glue the magnet rubbers to the back of the CRT.

WARNING: Do not remove or change the position of the factory installed wedges. These wedges were installed by the CRT manufacturer and are properly placed for this CRT; their removal may result in damage to the CRT.

6-4-3 Bow Convergence Adjustments

CONDITIONS

Orientation: Monitor facing east.
Display Image: Crosshatch pattern with mixed RGB colors.
Required tools: Philips (+) screwdriver, 1.5 mm Hexkey, 2.5 mm

PROCEDURE

Bow convergence adjustments are not available for the CRTs used in the CHA42*7L/5**7L monitors. While all CRTs have bow convergence magnets, they are sealed in the CRT factory and are not user or service technician adjustable. Do not touch these magnets (see Figure 6-11). If bow convergence adjustment is out of alignment, replace the CRT.

Bow misconvergence should not exceed the values listed in Table 6-5: Misconvergence Tolerances.

6-4-4 Balance Convergence Adjustments

Balance Convergence involves alignment of red and blue lines when they are misaligned at one end more so than at the other end. The Deflection Yoke holds the balance coils which can correct balance misconvergences.

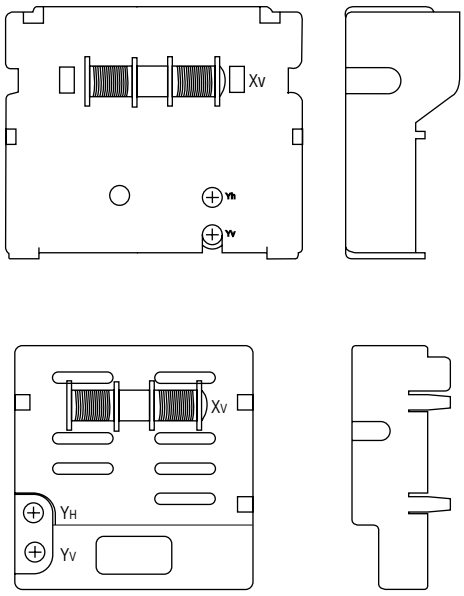


Figure 6-13. Deflection Yoke Caps

6-4-4 (a) HORIZONTAL LINE RED AND BLUE BALANCE CONVERGENCE

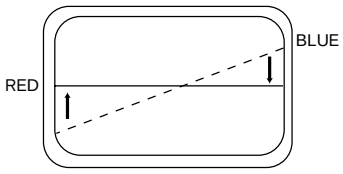


Figure 6-14. Horizontal Line Balance Misconvergence

PROCEDURE

Use a 2.5 mm hexkey at the Horizontal Balance Coil (Xv). Turning it right raises the right end of the blue line and lowers the left end. Turning the VR to the left lowers the right end of the blue line and raises the left end.

6-4-4 (b) VERTICAL RED AND BLUE BALANCE CONVERGENCE

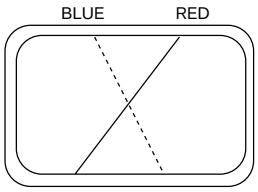


Figure 6-15. Vertical Line Balance Misconvergence

PROCEDURE

Use a 1.5 mm phillips (+) screwdriver at the YH variable resistor. Turning the VR to the left tilts the blue line to the right. Turning it right tilts the blue line to the left.

6-4-4 (c) UPPER AND LOWER HORIZONTAL LINE CONVERGENCE

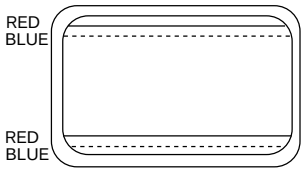


Figure 6-16. Upper and Lower Balance Misconvergence

PROCEDURE

Use a 1.5 mm phillips (+) screwdriver at theYv variable resistor. Turning the VR to the left moves the blue line at the top upward and at the bottom, the line moves downward. Turning it right moves the blue line at the top downward and at the bottom the line moves upward.

7 Troubleshooting

7-1 General Troubleshooting

Notes: 1. If a picture does not appear, fully rotate the brightness and contrast controls clockwise and reinspect.

2. Check the following circuits.
   - No raster appears: Power circuit, Horizontal output circuit, H/V control circuit, and H/V output circuit.
   - High voltage develops but no raster appears: Video output circuits.
   - High voltage does not develop: Horizontal output circuits.

7-1-1 No Picture

Check signal cable connection, H/V Sync input.
Check Timing mode (14": 30~55kHz, 15": 30~61kHz).
Check Cont, Brit key (all Max) and Screen VR (G2).

↓

Check key components of secondary part. :
Q402, Q508, D515, D403, **D408,** D409, **Q410,** Rectifier diodes (**D615,** D611, D608, D616, D617), **IC101** (Vcc~GND)

↓

Check key components of primary part. :
FH601, TH602, **D604 ~ D607, IC602,** OP601

↓

Refer to 7-2-16 No Video.

↓

Check SW211 (Power key) : Does IC202's #2 voltage vary vary from 5V to 0V, when pressing SW211?

↓

Refer to 7-2-1 No Power.

↓

Refer to 7-2-3 No Raster and 7-2-12 High Voltage Failure.

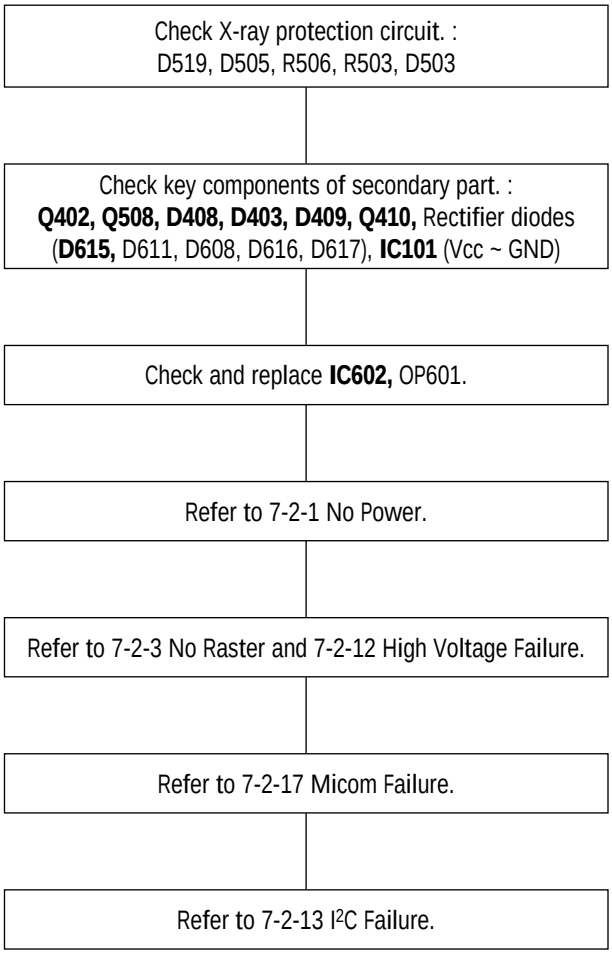
↓

Refer to 7-2-17 Micom Failure.

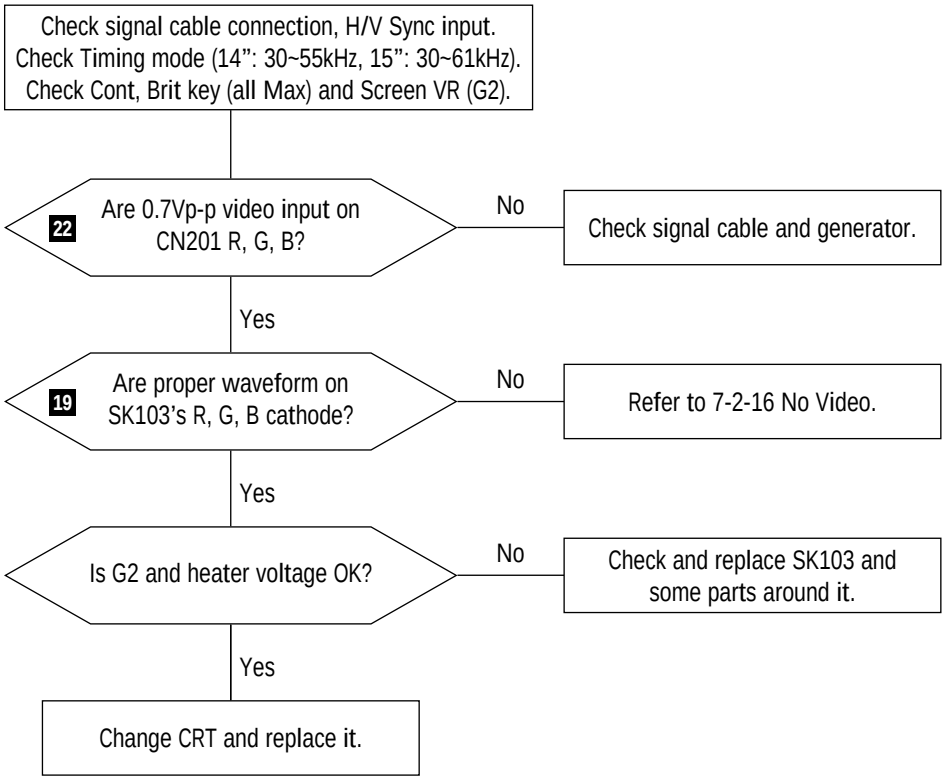
↓

Refer to 7-2-13 I^2C Failure.

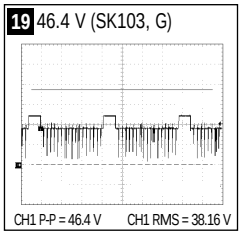
7-1-2 Shut Down

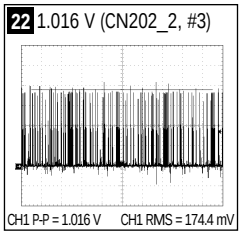

Check X-ray protection circuit. :
D519, D505, R506, R503, D503
Check key components of secondary part. :
Q402, Q508, D408, D403, D409, Q410, Rectifier diodes
(**D615,** D611, D608, D616, D617), **IC101** (Vcc ~ GND)
Check and replace **IC602,** OP601.
Refer to 7-2-1 No Power.
Refer to 7-2-3 No Raster and 7-2-12 High Voltage Failure.
Refer to 7-2-17 Micom Failure.
Refer to 7-2-13 I²C Failure.

7-1-3 No Video or Missing Colors

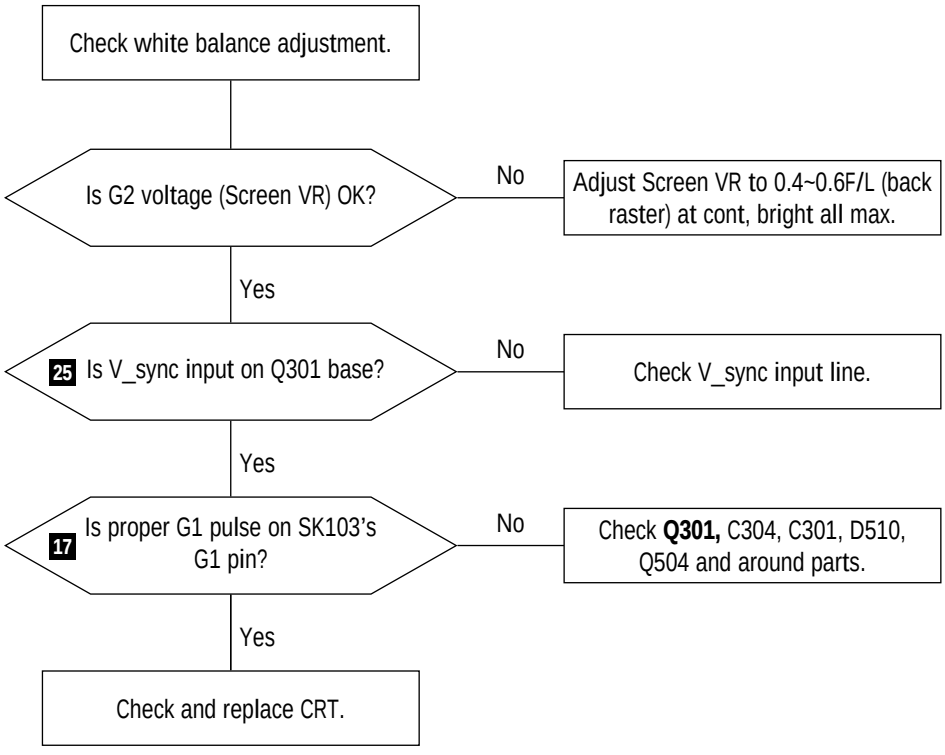

Check signal cable connection, H/V Sync input.
Check Timing mode (14": 30~55kHz, 15": 30~61kHz).
Check Cont, Brit key (all Max) and Screen VR (G2).
22 Are 0.7Vp-p video input on CN201 R, G, B?
No
Check signal cable and generator.
Yes
19 Are proper waveform on SK103's R, G, B cathode?
No
Refer to 7-2-16 No Video.
Yes
Is G2 and heater voltage OK?
No
Check and replace SK103 and some parts around it.
Yes
Change CRT and replace it.

WAVEFORMS

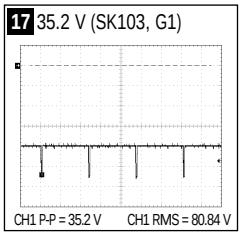


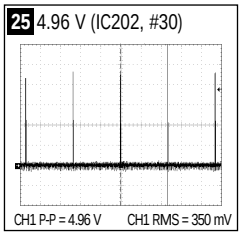


7-1-4 Visible Retrace

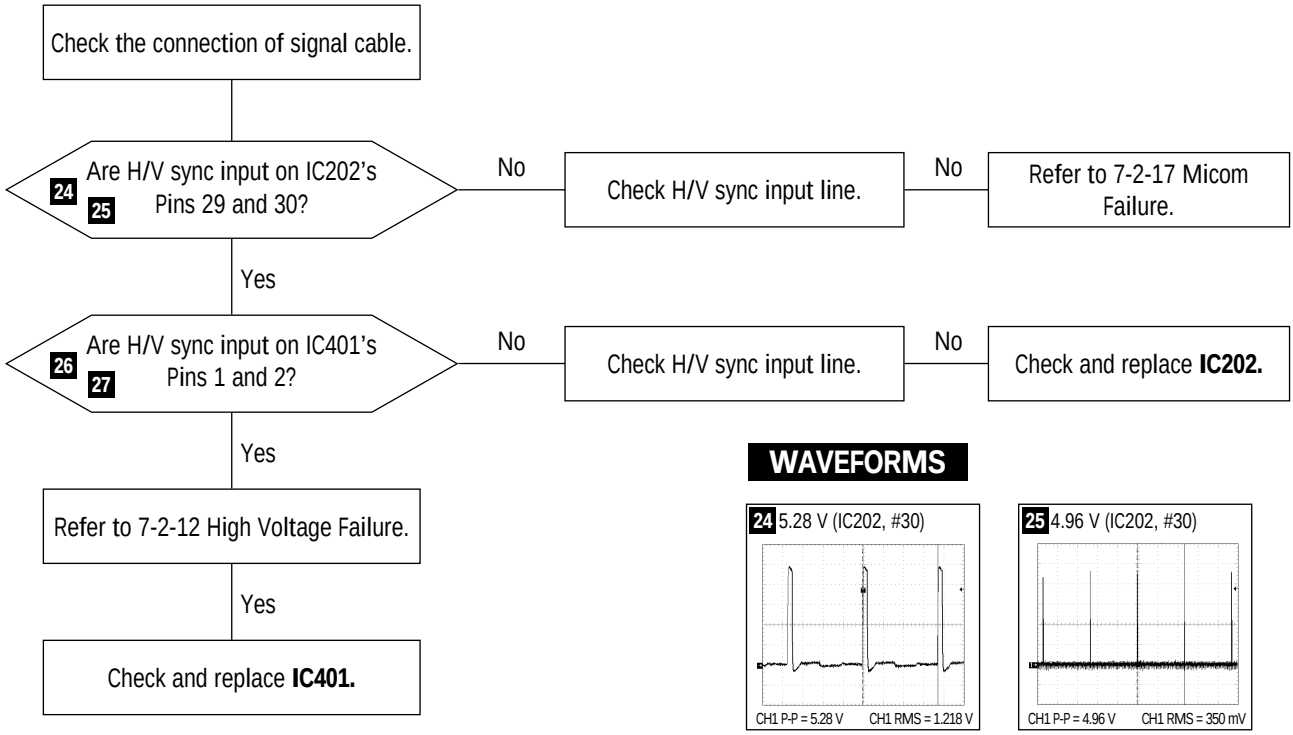

Check white balance adjustment.
Is G2 voltage (Screen VR) OK?
No
Adjust Screen VR to 0.4~0.6F/L (back raster) at cont, bright all max.
Yes
25 Is V_sync input on Q301 base?
No
Check V_sync input line.
Yes
17 Is proper G1 pulse on SK103's G1 pin?
No
Check Q301, C304, C301, D510, Q504 and around parts.
Yes
Check and replace CRT.

WAVEFORMS

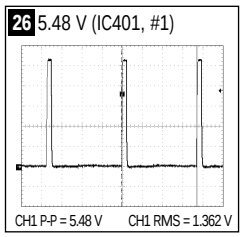


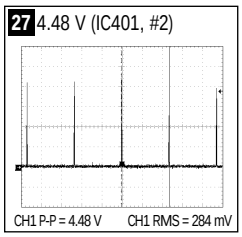


7-1-5 Unsynchronized image

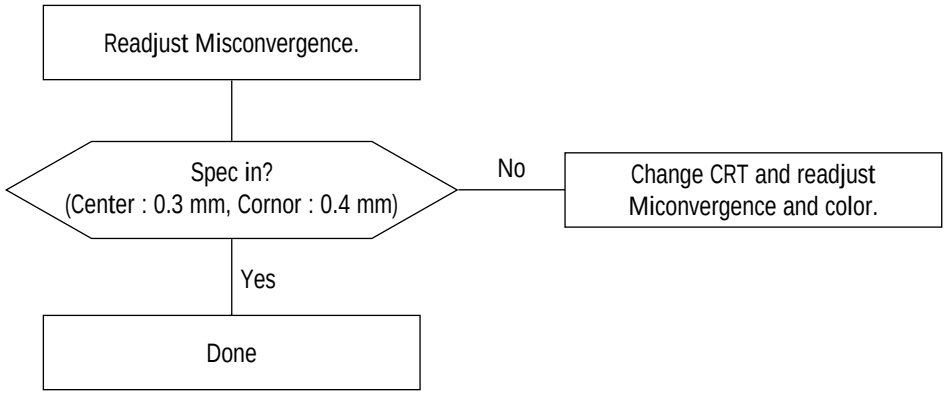

Check the connection of signal cable.
24 25 Are H/V sync input on IC202's Pins 29 and 30?
No
Check H/V sync input line.
No
Refer to 7-2-17 Micom Failure.
Yes
26 27 Are H/V sync input on IC401's Pins 1 and 2?
No
Check H/V sync input line.
No
Check and replace IC202.
Yes
Refer to 7-2-12 High Voltage Failure.
Yes
Check and replace IC401.

WAVEFORMS

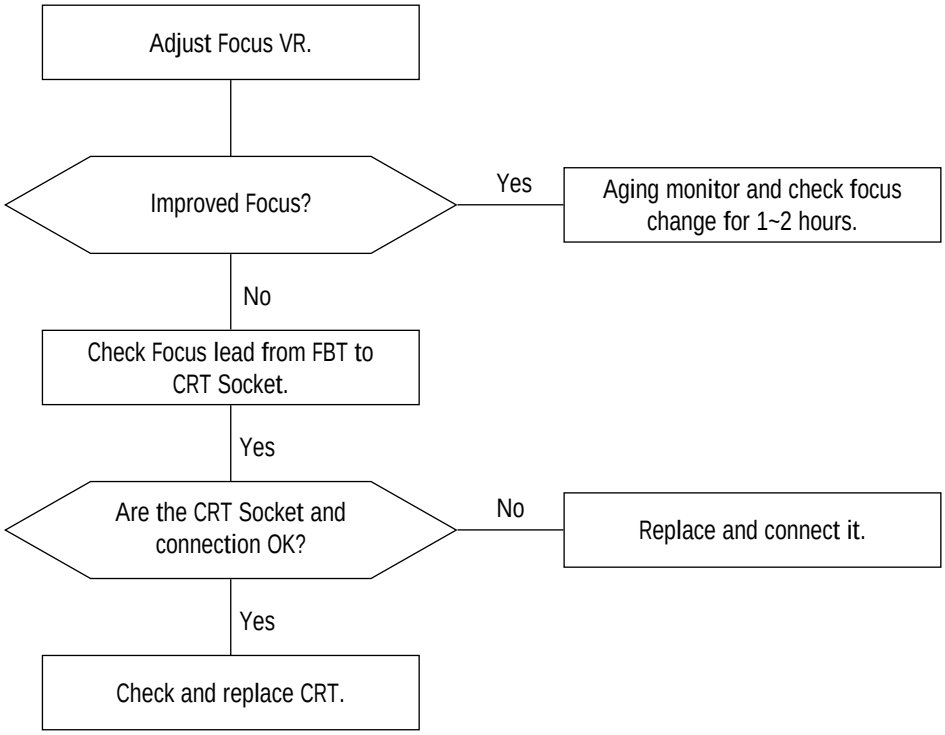




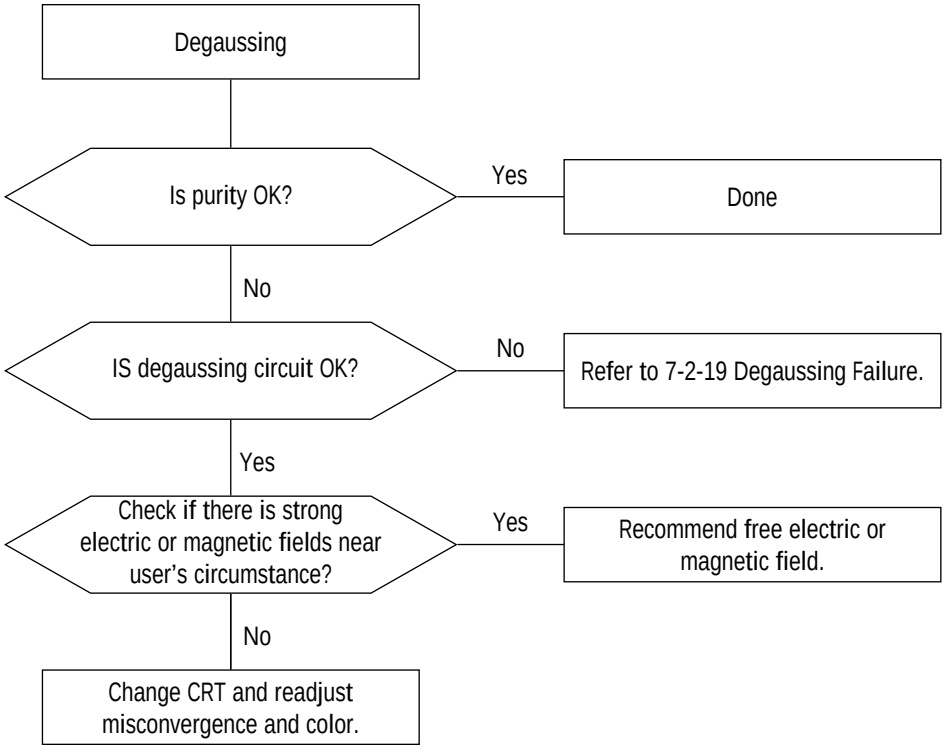
7-1-6 Misconvergence



7-1-7 Poor Focus



7-1-8 Purity Failure

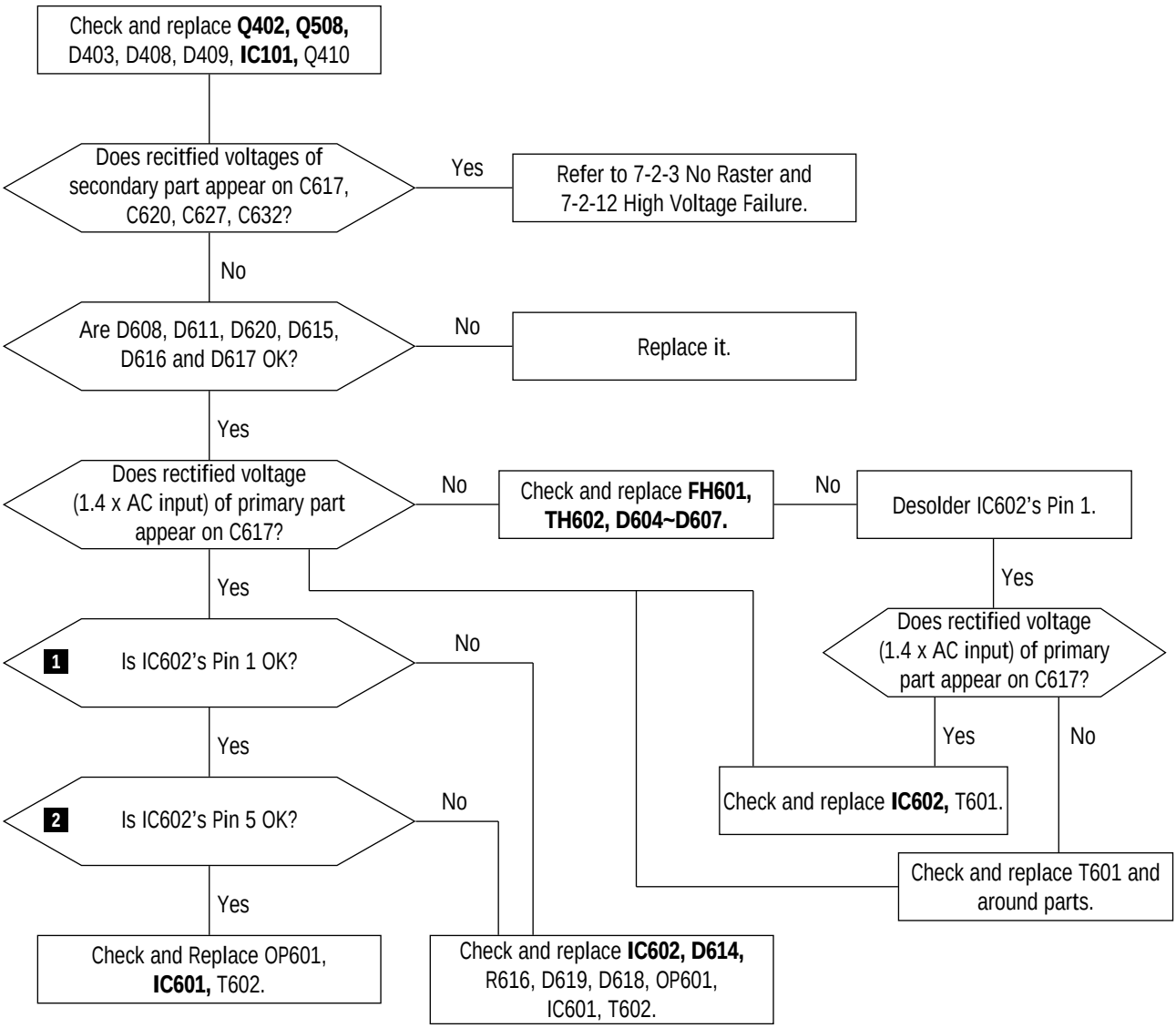


7-2 Detail Repair Section

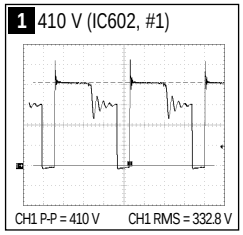
Notes: 1. If a picture does not appear

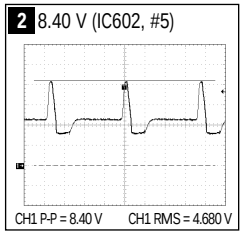
check first
- if AC power cord is plugged or not,
- if signal cable is connected or not,
- if signal generator (PC) is operated well or not (DPMS mode)
- if the Timing mode is out of spec or not (14": 30~55 kHz, 15": 30~61 kHz)

7-2-1 No Power


Check and replace **Q402, Q508,** D403, D408, D409, **IC101,** Q410
Does recitfied voltages of secondary part appear on C617, C620, C627, C632?
Yes
Refer to 7-2-3 No Raster and 7-2-12 High Voltage Failure.
No
Are D608, D611, D620, D615, D616 and D617 OK?
No
Replace it.
Yes
Does rectified voltage (1.4 x AC input) of primary part appear on C617?
No
Check and replace **FH601, TH602, D604~D607.**
No
Desolder IC602's Pin 1.
Yes
Does rectified voltage (1.4 x AC input) of primary part appear on C617?
Yes
No
Check and replace **IC602,** T601.
Check and replace T601 and around parts.
Yes
1 Is IC602's Pin 1 OK?
No
Yes
2 Is IC602's Pin 5 OK?
No
Yes
Check and Replace OP601, **IC601,** T602.
Check and replace **IC602, D614,** R616, D619, D618, OP601, IC601, T602.

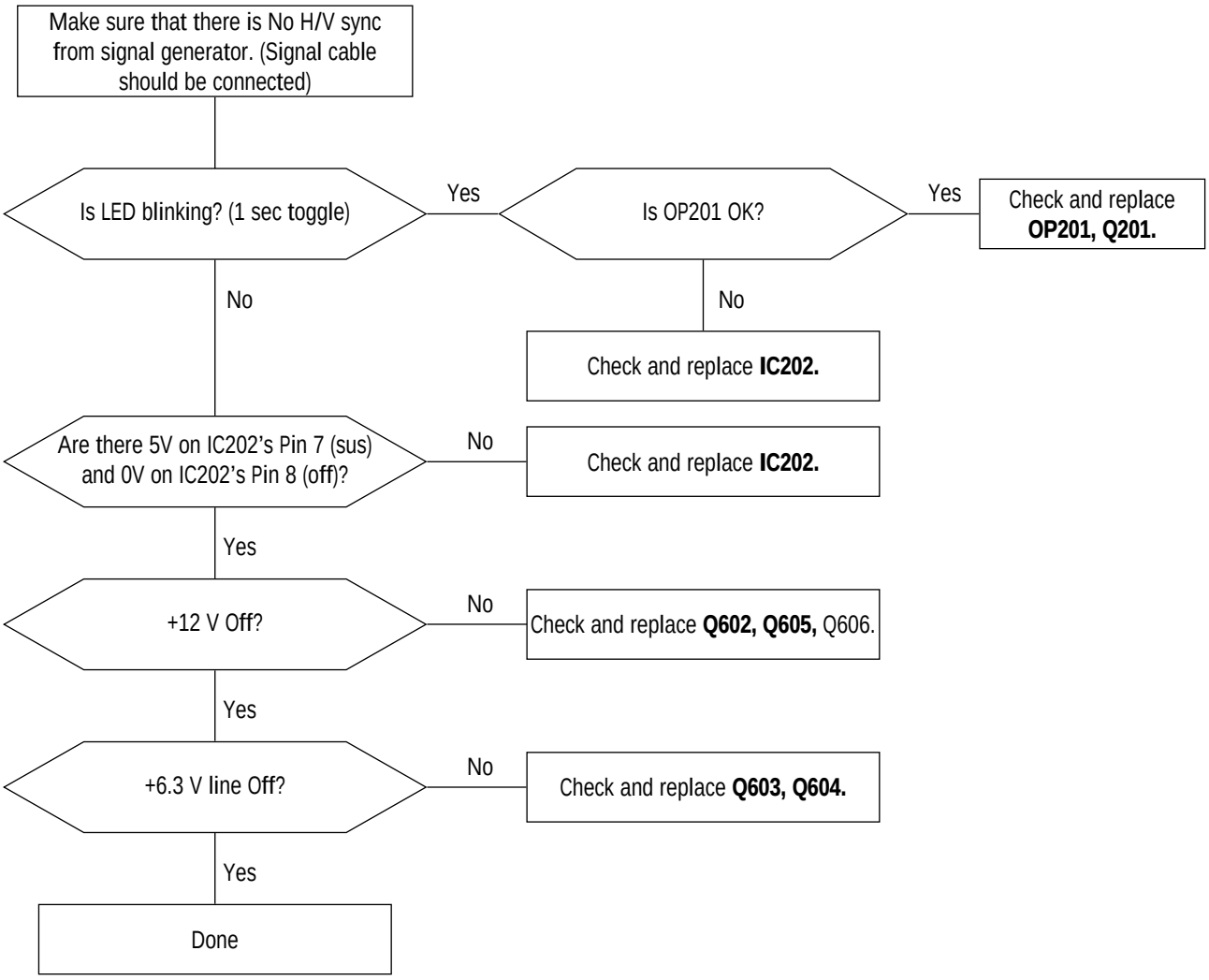
WAVEFORMS



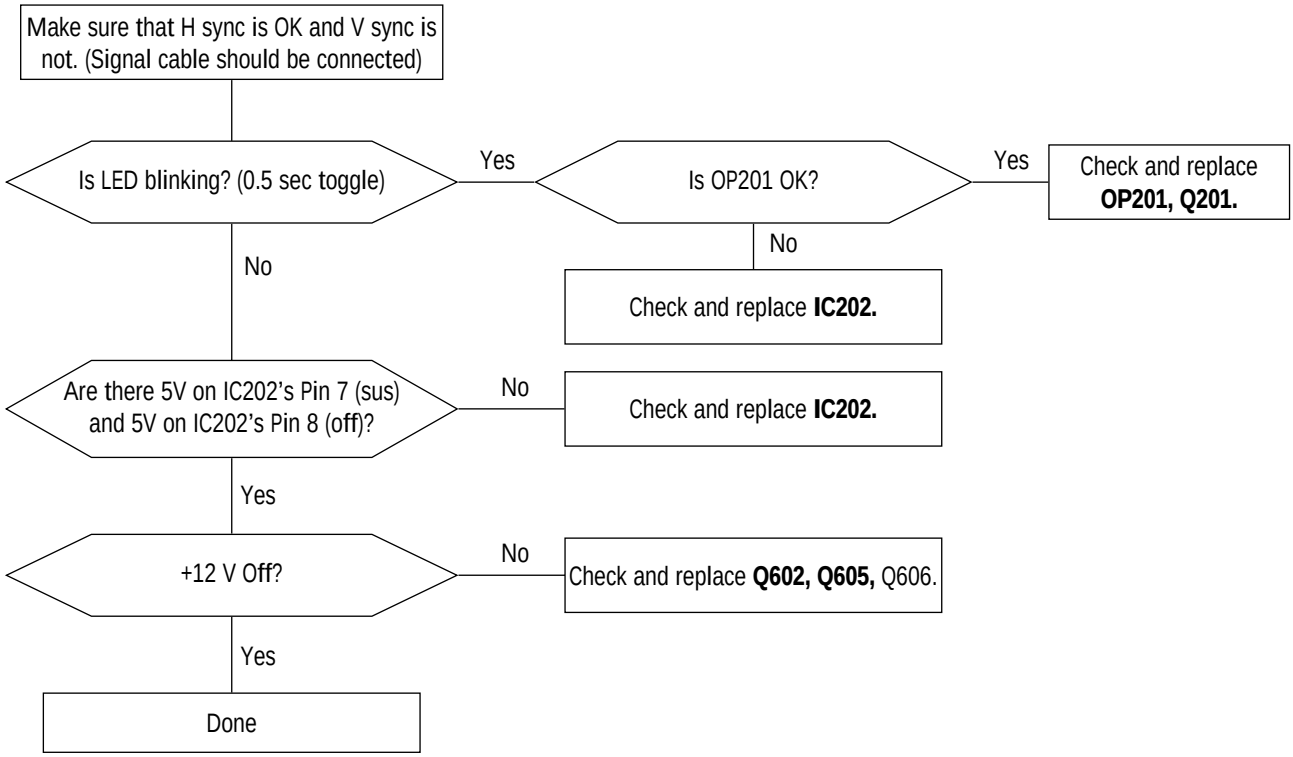


7-2-2 DPMS Failure

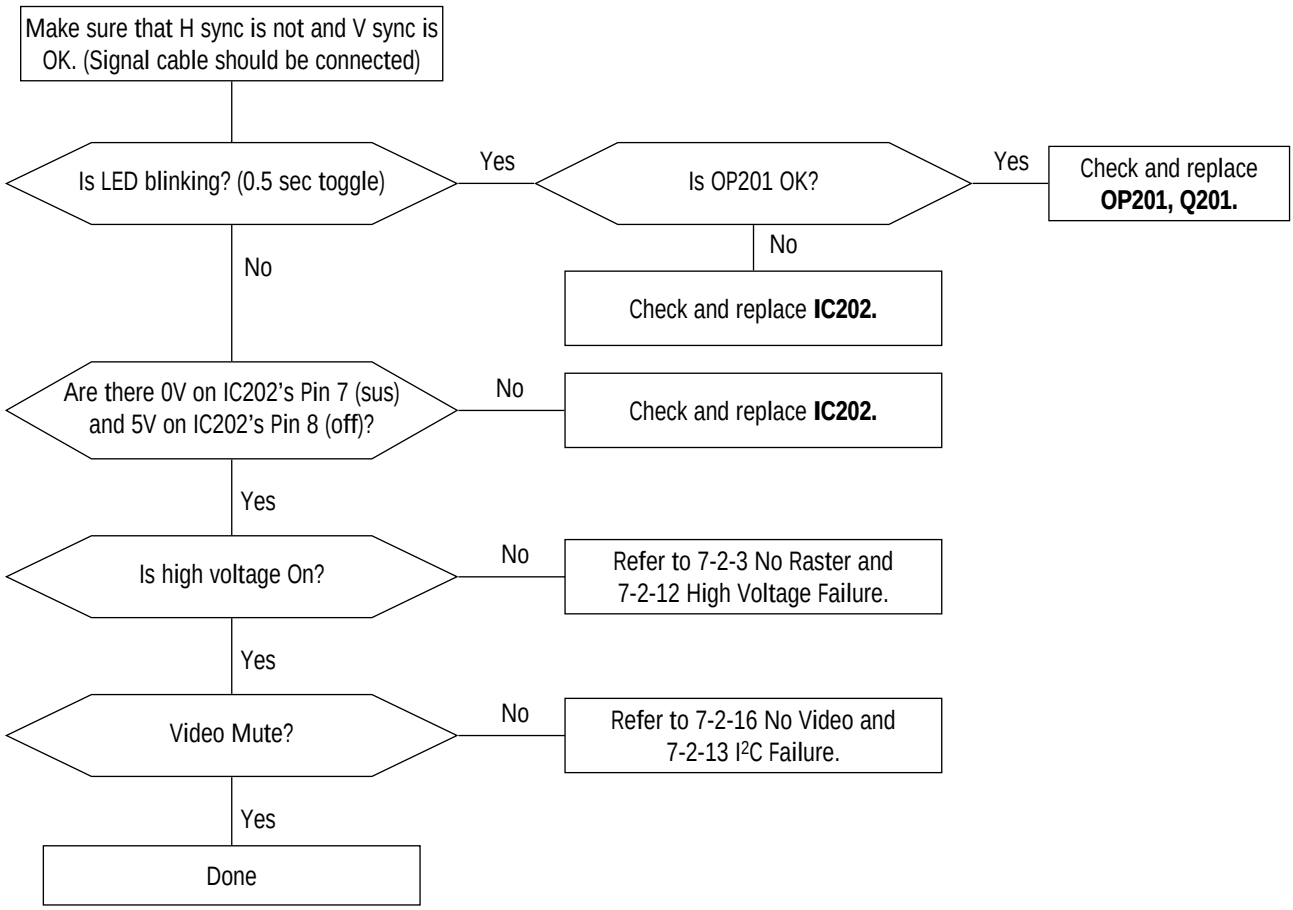
7-2-2 (a) Off Mode (No H/V sync)



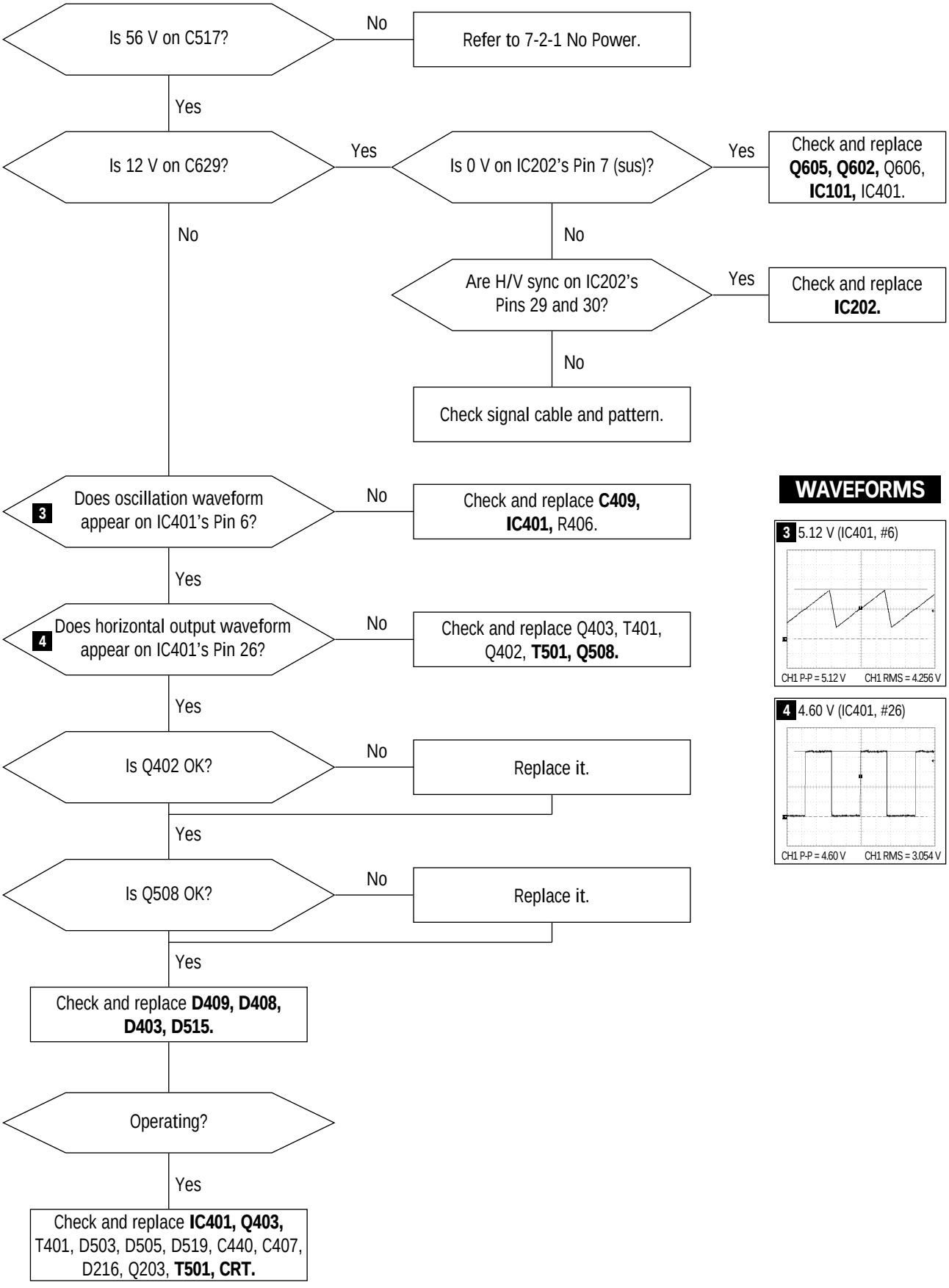
7-2-2 (b) Suspend Mode (H sync: OK, V sync: No)


Make sure that H sync is OK and V sync is not. (Signal cable should be connected)
Is LED blinking? (0.5 sec toggle)
Yes
Is OP201 OK?
Yes
Check and replace OP201, Q201.
No
Check and replace IC202.
No
Are there 5V on IC202's Pin 7 (sus) and 5V on IC202's Pin 8 (off)?
No
Check and replace IC202.
Yes
+12 V Off?
No
Check and replace Q602, Q605, Q606.
Yes
Done

7-2-2 (c) Stand-by Mode (H sync: No, V sync: OK)


Make sure that H sync is not and V sync is OK. (Signal cable should be connected)
Is LED blinking? (0.5 sec toggle)
Yes
Is OP201 OK?
Yes
Check and replace OP201, Q201.
No
Check and replace IC202.
No
Are there 0V on IC202's Pin 7 (sus) and 5V on IC202's Pin 8 (off)?
No
Check and replace IC202.
Yes
Is high voltage On?
No
Refer to 7-2-3 No Raster and 7-2-12 High Voltage Failure.
Yes
Video Mute?
No
Refer to 7-2-16 No Video and 7-2-13 I2C Failure.
Yes
Done

7-2-3 No Raster : No Raster means (Power: OK, High Voltage: No)



WAVEFORMS

3 5.12 V (IC401, #6)

4 4.60 V (IC401, #26)

7-2-4 S-correction Failure

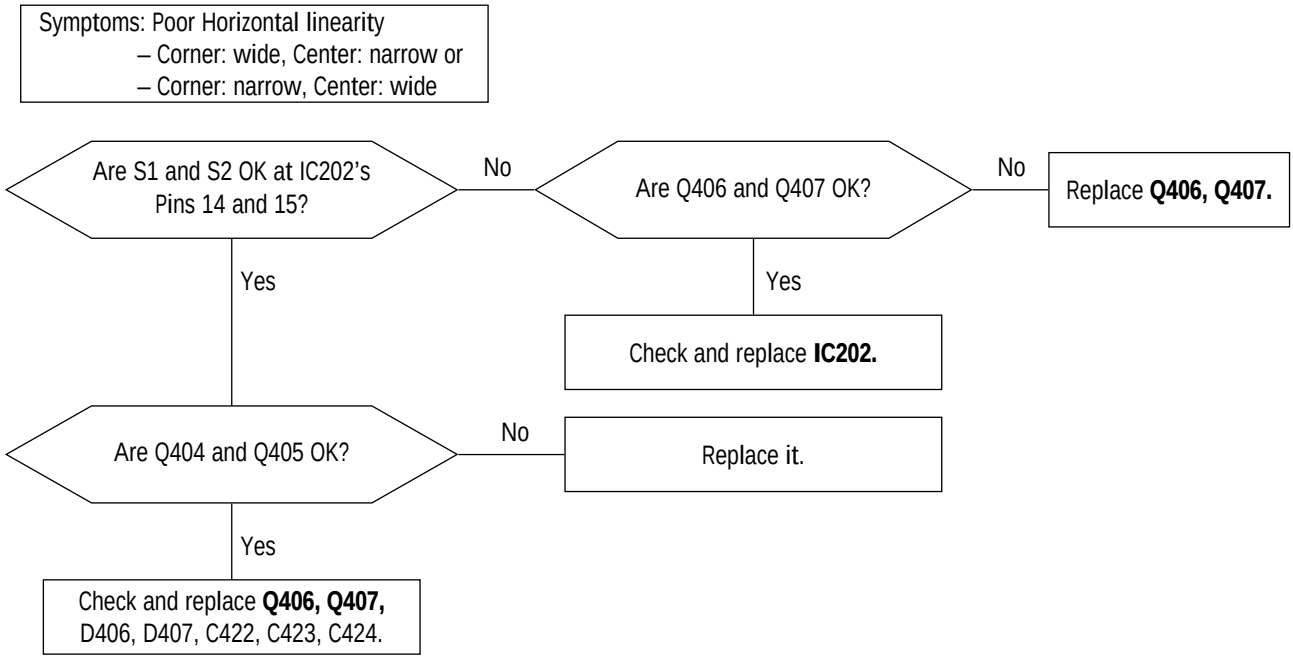
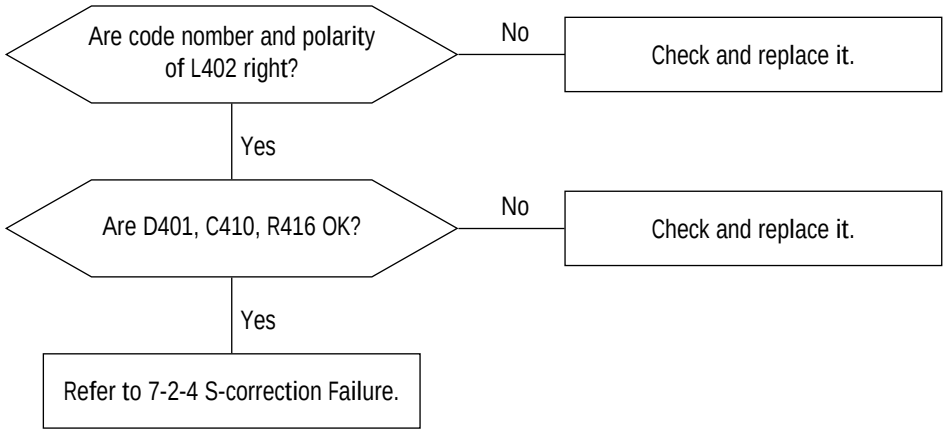


Table 7-1.

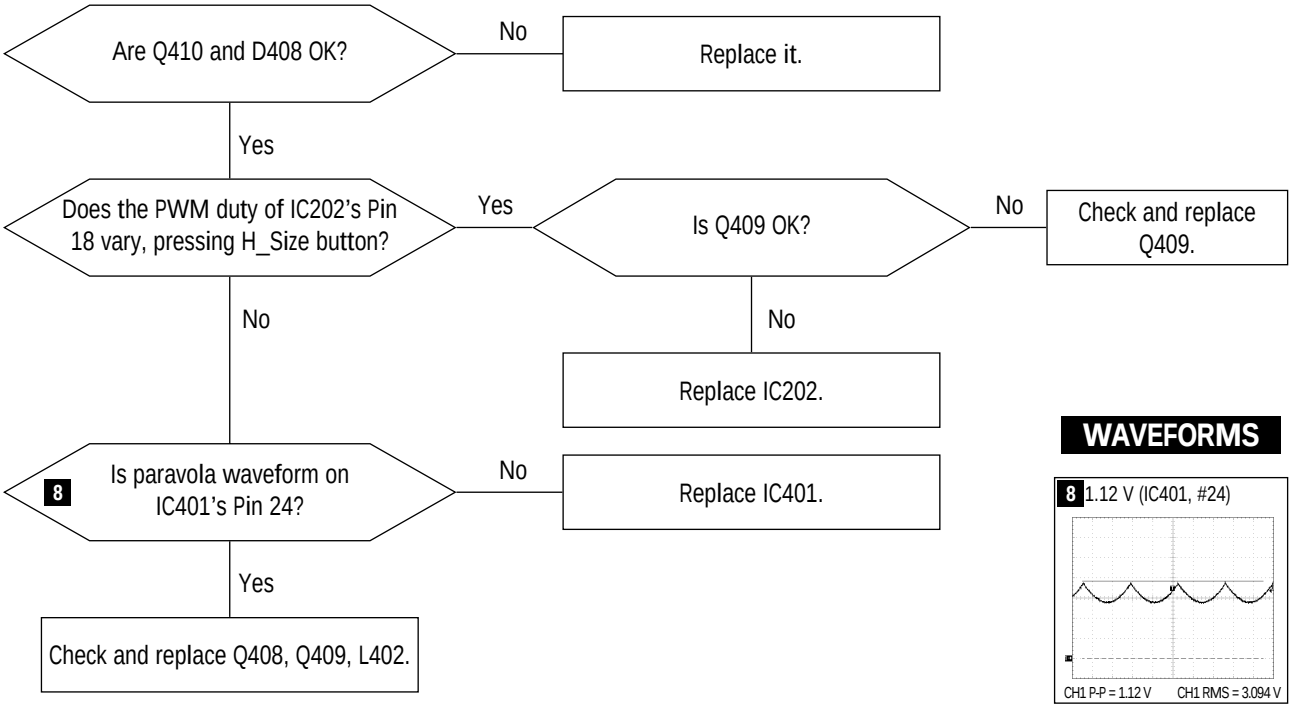
	31 ~ 36	36 ~ 41	41 ~ 50	50 ~ 61
S1	0 V	0 V	5 V	5 V
S2	0 V	5 V	0 V	5 V

* As CRT vendor and inch, there are differential items like L401, C422, C423, C424, R426, R212.
If you want to change a PCB board to another one that is for different CRT and inch, you have to change differential items at schematic diagram.

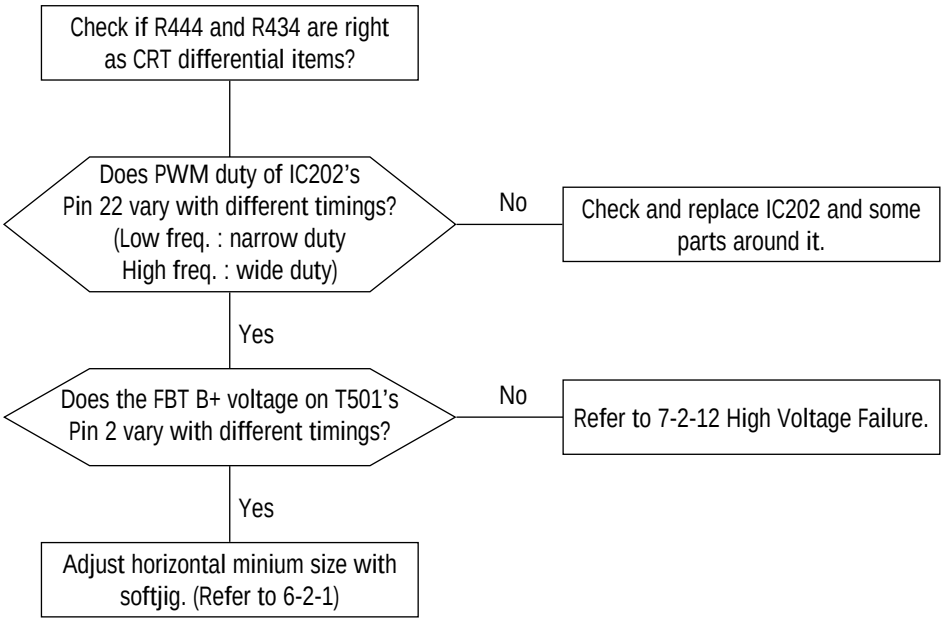
7-2-5 H-Linearity Failure



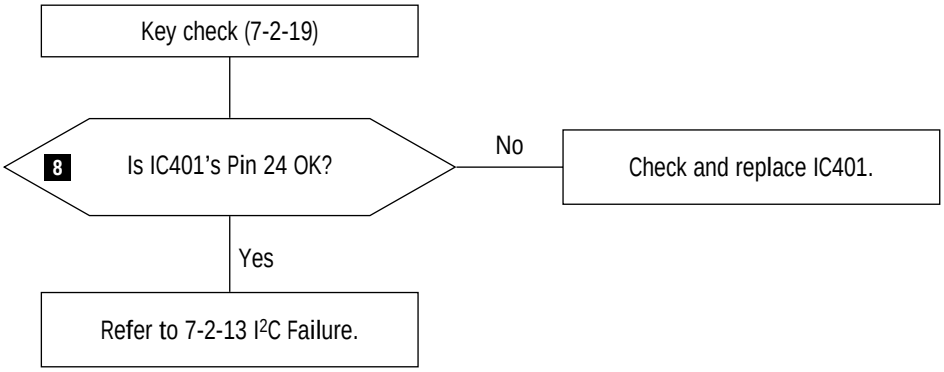
7-2-6 Invariable H_Size



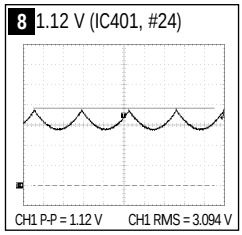
7-2-7 Abnormal H_Size


Check if R444 and R434 are right as CRT differential items?
Does PWM duty of IC202's Pin 22 vary with different timings? (Low freq. : narrow duty High freq. : wide duty)
No
Check and replace IC202 and some parts around it.
Yes
Does the FBT B+ voltage on T501's Pin 2 vary with different timings?
No
Refer to 7-2-12 High Voltage Failure.
Yes
Adjust horizontal minium size with softjig. (Refer to 6-2-1)

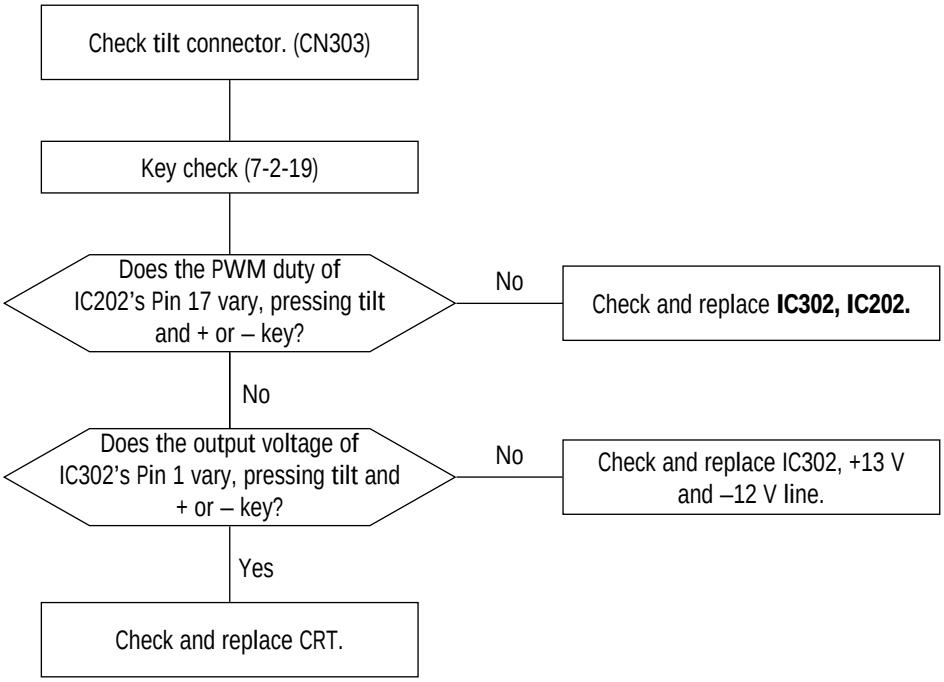
7-2-8 S_Pin, Trap, Para, V_Lin, Pin_Bal Failure



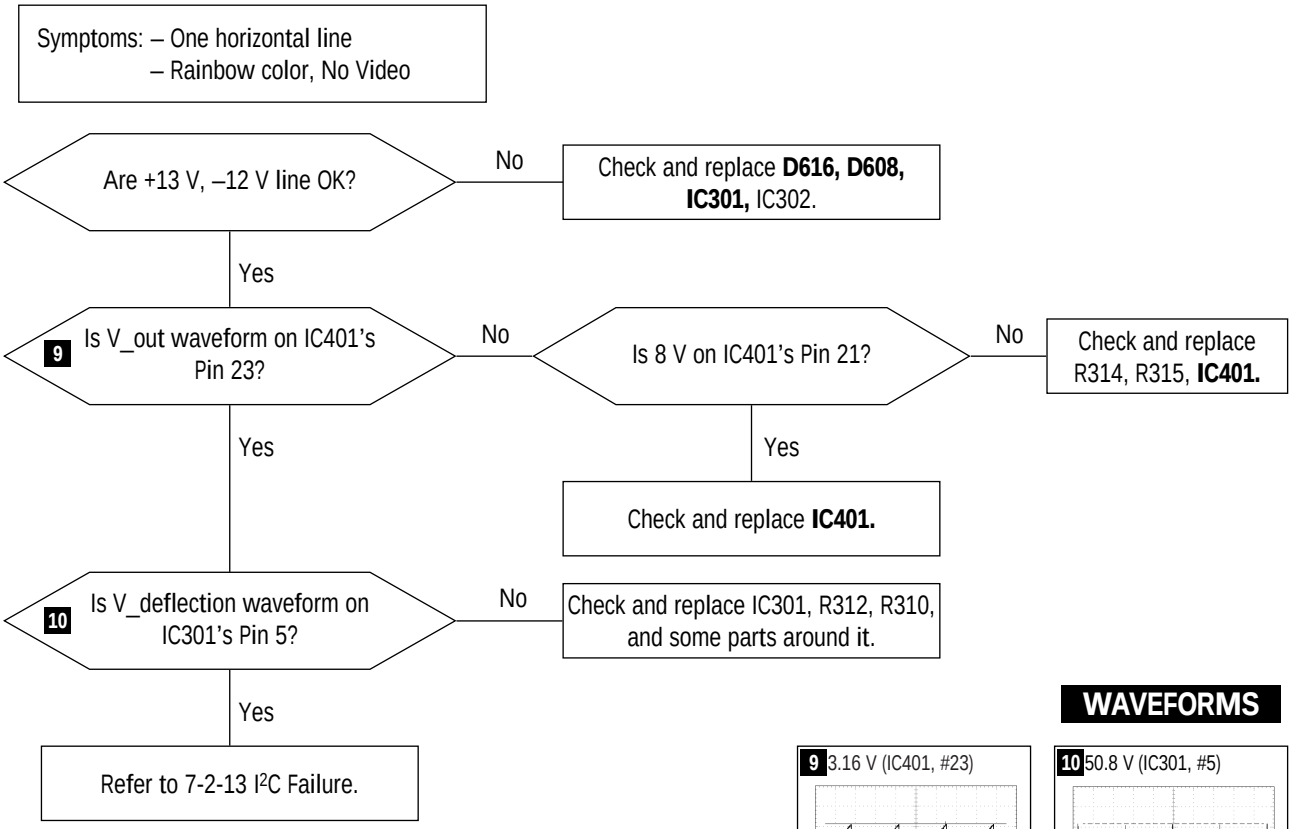
WAVEFORMS



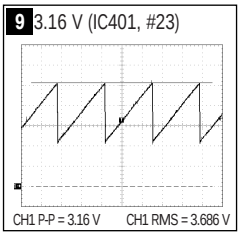
7-2-9 Tilt Failure

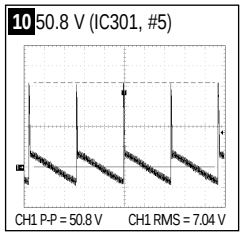

Check tilt connector. (CN303)
Key check (7-2-19)
Does the PWM duty of IC202's Pin 17 vary, pressing tilt and + or – key?
No
Check and replace IC302, IC202.
No
Does the output voltage of IC302's Pin 1 vary, pressing tilt and + or – key?
No
Check and replace IC302, +13 V and –12 V line.
Yes
Check and replace CRT.

7-2-10 Vertical Deflection Failure

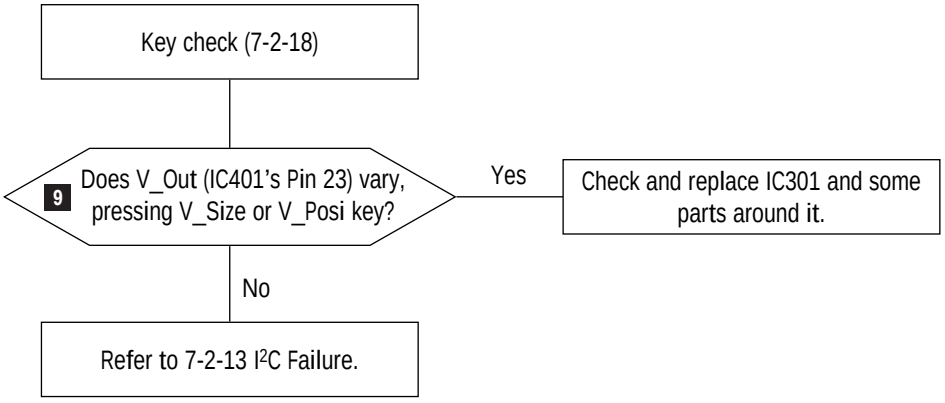

Symptoms: – One horizontal line
– Rainbow color, No Video
Are +13 V, –12 V line OK?
No
Check and replace **D616, D608, IC301,** IC302.
Yes
9 Is V_out waveform on IC401's Pin 23?
No
Is 8 V on IC401's Pin 21?
No
Check and replace R314, R315, **IC401.**
Yes
Yes
Check and replace **IC401.**
10 Is V_deflection waveform on IC301's Pin 5?
No
Check and replace IC301, R312, R310, and some parts around it.
Yes
Refer to 7-2-13 I²C Failure.

WAVEFORMS

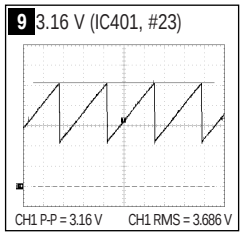




7-2-11 Invariable V_Size or V_Position


Key check (7-2-18)
9 Does V_Out (IC401's Pin 23) vary, pressing V_Size or V_Posi key?
Yes
Check and replace IC301 and some parts around it.
No
Refer to 7-2-13 I²C Failure.

WAVEFORMS



7-2-12 High Voltage Failure

Symptoms 1: – No Power
– No Raster
– Unstable operation (Fixed FBT B+ voltage with different H_frequency, Over 31 kHz: whistle sound, Narrow H_Size, Unsynchronized image, 31 kHz: OK)

Is 56 V on C617?
No → Refer to 7-2-1 No Power.
Yes

13 Is Q508's drain waveform ok?
No → Are Q508, D515, L501 ok?
No → Check and replace it.
Yes → 11 Are Q402, D409, D408, D403 and Q410 ok?
No → Check and replace it.
Yes → Check and replace AFC input line from T501 to IC401's Pin 12. : **D412, D413,** C441, R401.

Yes

Does the PWM duty of IC202's Pin 16 vary with different H_freq.?
No → Check and replace IC202, **Q203,** D216.
Yes

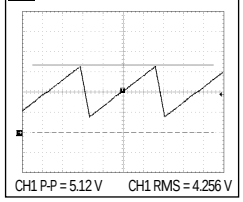
Are D503, D505, D519, R508, R506, R530, Q203, D216 and D415 ok?
No → Check and replace it.
Yes

12 Does B_Out duty of IC401's Pin 28 vary with different H_frequency and image load (Full White or No Video)?
No → Check and replace **IC401,** Q507, Q509, **T501** and REG_IN line to IC401's Pin 15.
Yes

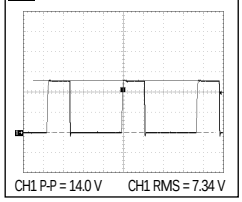
Check and replace Q507, Q509, IC401, T501.

WAVEFORMS

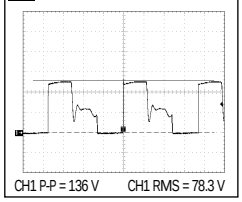
11



12 14.0 V (IC401, #28)



13 136 V (Q508, Drain)



Symptoms 2: – X-ray protection
– One vertical line and then high voltage shut down.

Are D505, C502, R506, R503 and C445 ok?

No → Check and replace it.

Yes

Check and replace **Q402, Q508, D409, D408, D403, IC401.**

Check and replace **Q203, IC202.**

7-2-13 I²C Failure

– Almost data (Horizontal drive duty, FBT B+ duty, display image data, color data) is transferred from IC203 to IC101 and IC401 through I2C data line during power on.
– After user adjusts display image data, contrast and brightness data, these are saved to IC203.

Key check (7-2-18)

Is 5 V on IC401's Pin 32 and IC203's Pin 8?

No → Check and replace it.

Yes

14 Is there data communication on IC401's Pins 30 and 31?

No → Check I²C data and clock line.

Yes

14 Is there data communication on IC401's Pins 30 and 31 during I²C function? (H/V Posi, V_Size, S_Pin, Trap, Cont, Brit)

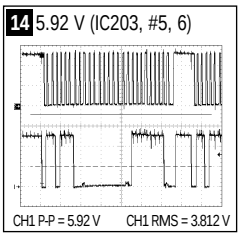
No → Check and replace I²C devices. **(IC101, IC401, IC203)**

Yes

Done

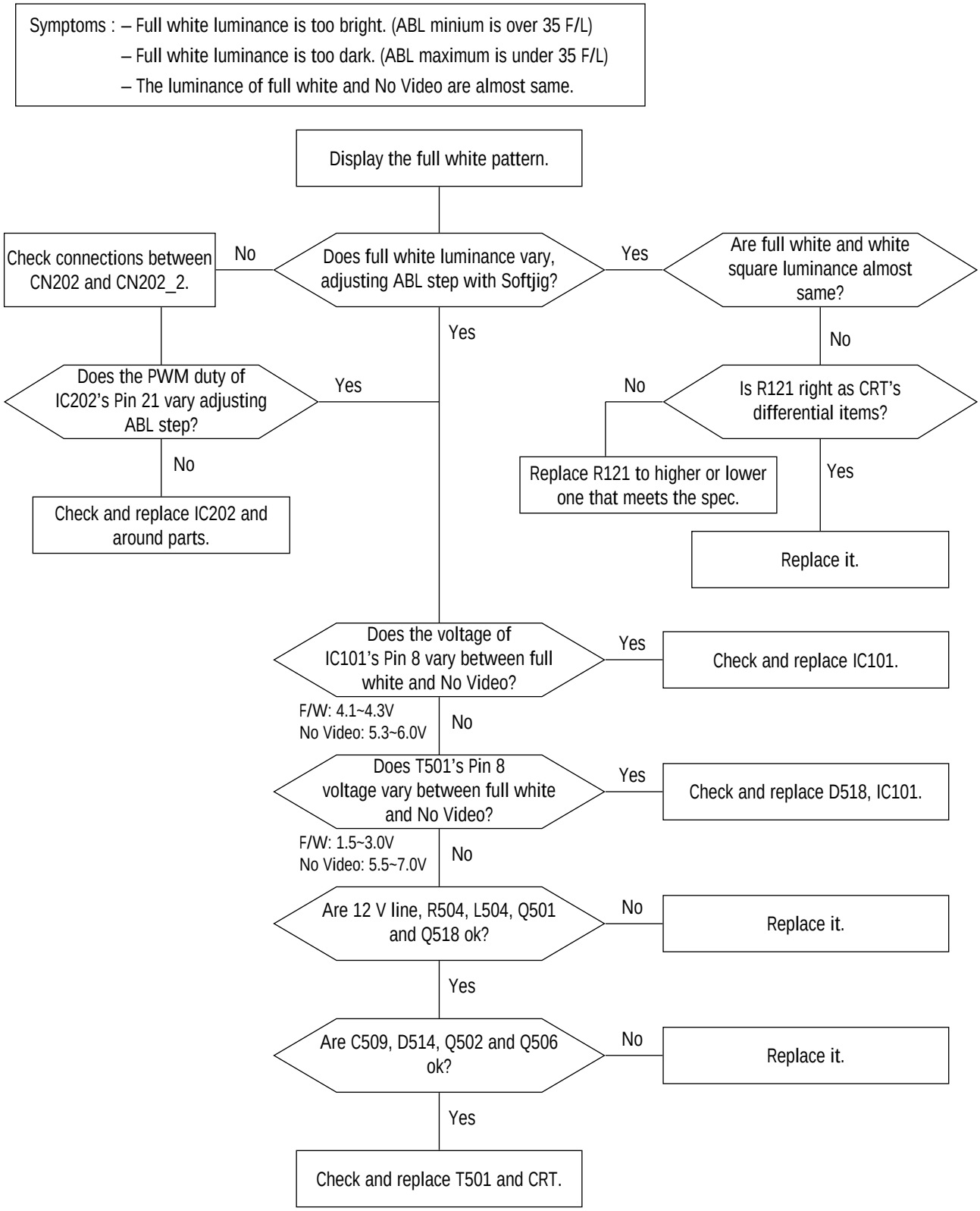
WAVEFORMS

14 5.92 V (IC203, #5, 6)

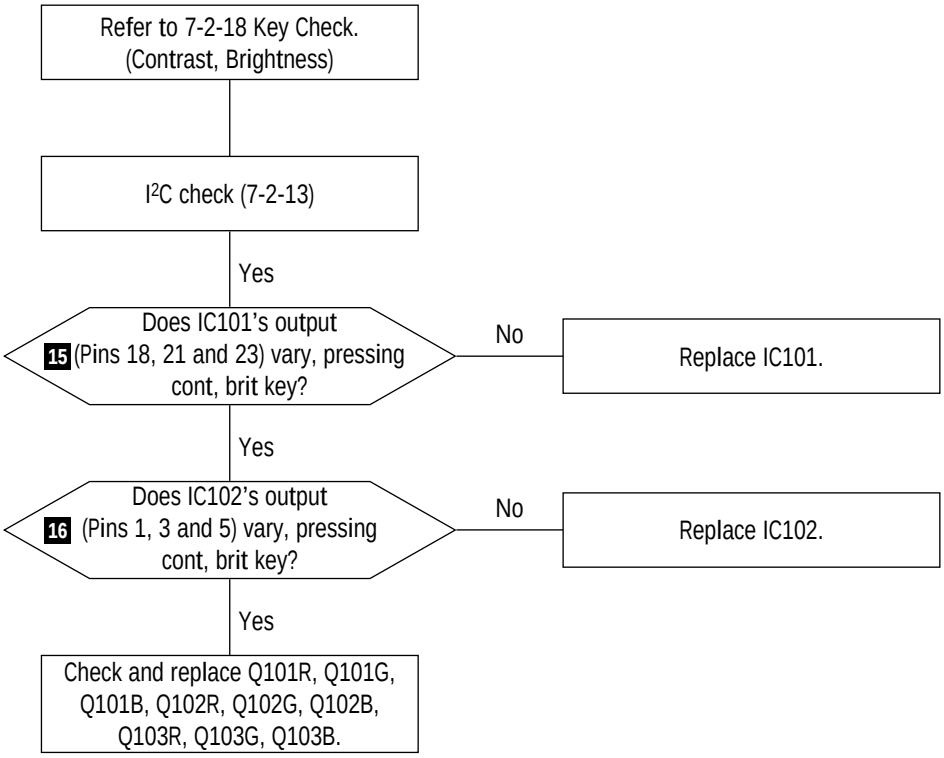


CH1 : IC401's Pin 31
CH2 : IC401's Pin 30

7-2-14 ABL Failure

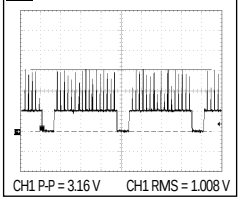

Symptoms : – Full white luminance is too bright. (ABL minium is over 35 F/L)
– Full white luminance is too dark. (ABL maximum is under 35 F/L)
– The luminance of full white and No Video are almost same.
Display the full white pattern.
Does full white luminance vary, adjusting ABL step with Softjig?
No
Check connections between CN202 and CN202_2.
Yes
Are full white and white square luminance almost same?
No
Is R121 right as CRT's differential items?
No
Replace R121 to higher or lower one that meets the spec.
Yes
Replace it.
Yes
Does the PWM duty of IC202's Pin 21 vary adjusting ABL step?
Yes
No
Check and replace IC202 and around parts.
Does the voltage of IC101's Pin 8 vary between full white and No Video?
Yes
Check and replace IC101.
F/W: 4.1~4.3V
No Video: 5.3~6.0V
No
Does T501's Pin 8 voltage vary between full white and No Video?
Yes
Check and replace D518, IC101.
F/W: 1.5~3.0V
No Video: 5.5~7.0V
No
Are 12 V line, R504, L504, Q501 and Q518 ok?
No
Replace it.
Yes
Are C509, D514, Q502 and Q506 ok?
No
Replace it.
Yes
Check and replace T501 and CRT.

7-2-15 Invariable Contrast, Brightness Control

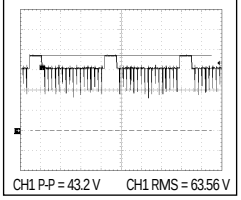


WAVEFORMS

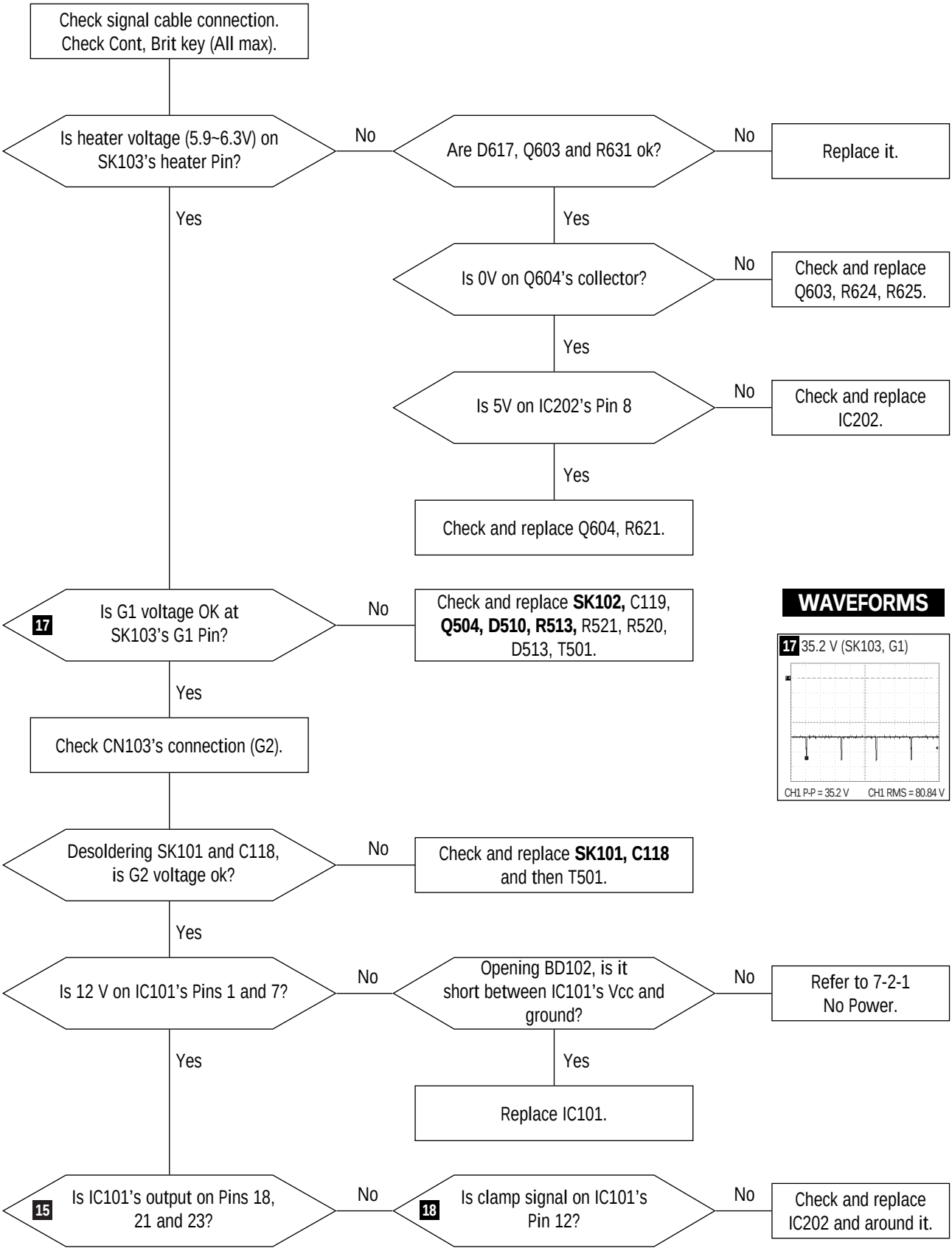
15 3.16 V (IC101, #21)



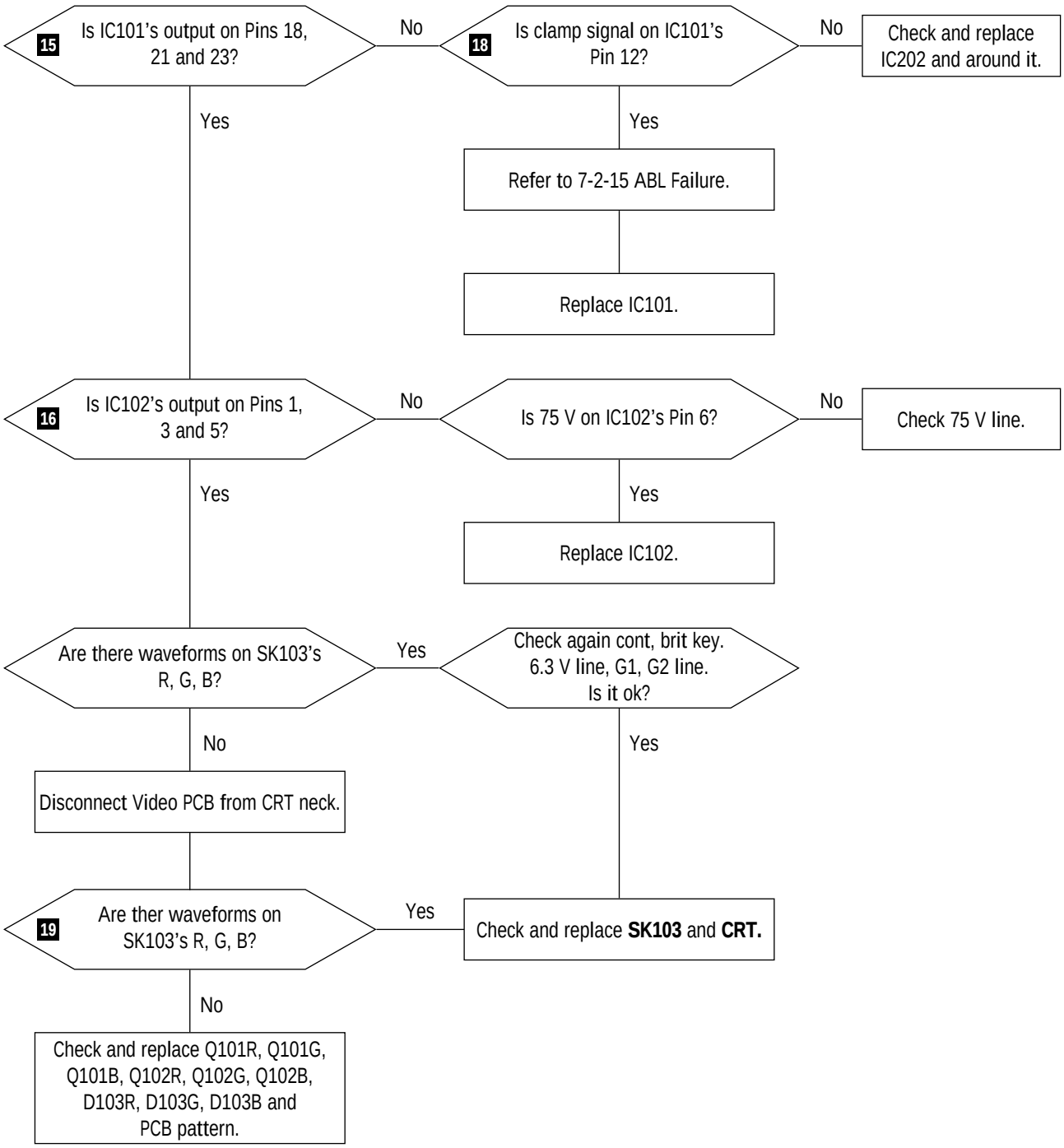
16 43.2 V (IC102, #3)



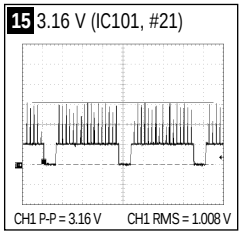
7-2-16 No Video

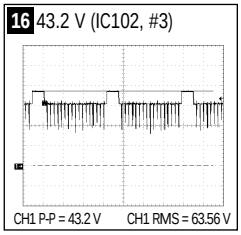


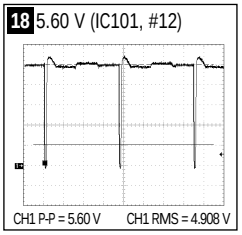
7-2-16 No Video Continued

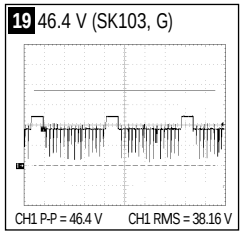

15 Is IC101's output on Pins 18, 21 and 23?
No
18 Is clamp signal on IC101's Pin 12?
No
Check and replace IC202 and around it.
Yes
Yes
Refer to 7-2-15 ABL Failure.
Replace IC101.
16 Is IC102's output on Pins 1, 3 and 5?
No
Is 75 V on IC102's Pin 6?
No
Check 75 V line.
Yes
Yes
Replace IC102.
Are there waveforms on SK103's R, G, B?
Yes
Check again cont, brit key. 6.3 V line, G1, G2 line. Is it ok?
No
Yes
Disconnect Video PCB from CRT neck.
19 Are ther waveforms on SK103's R, G, B?
Yes
Check and replace SK103 and CRT.
No
Check and replace Q101R, Q101G, Q101B, Q102R, Q102G, Q102B, D103R, D103G, D103B and PCB pattern.

WAVEFORMS

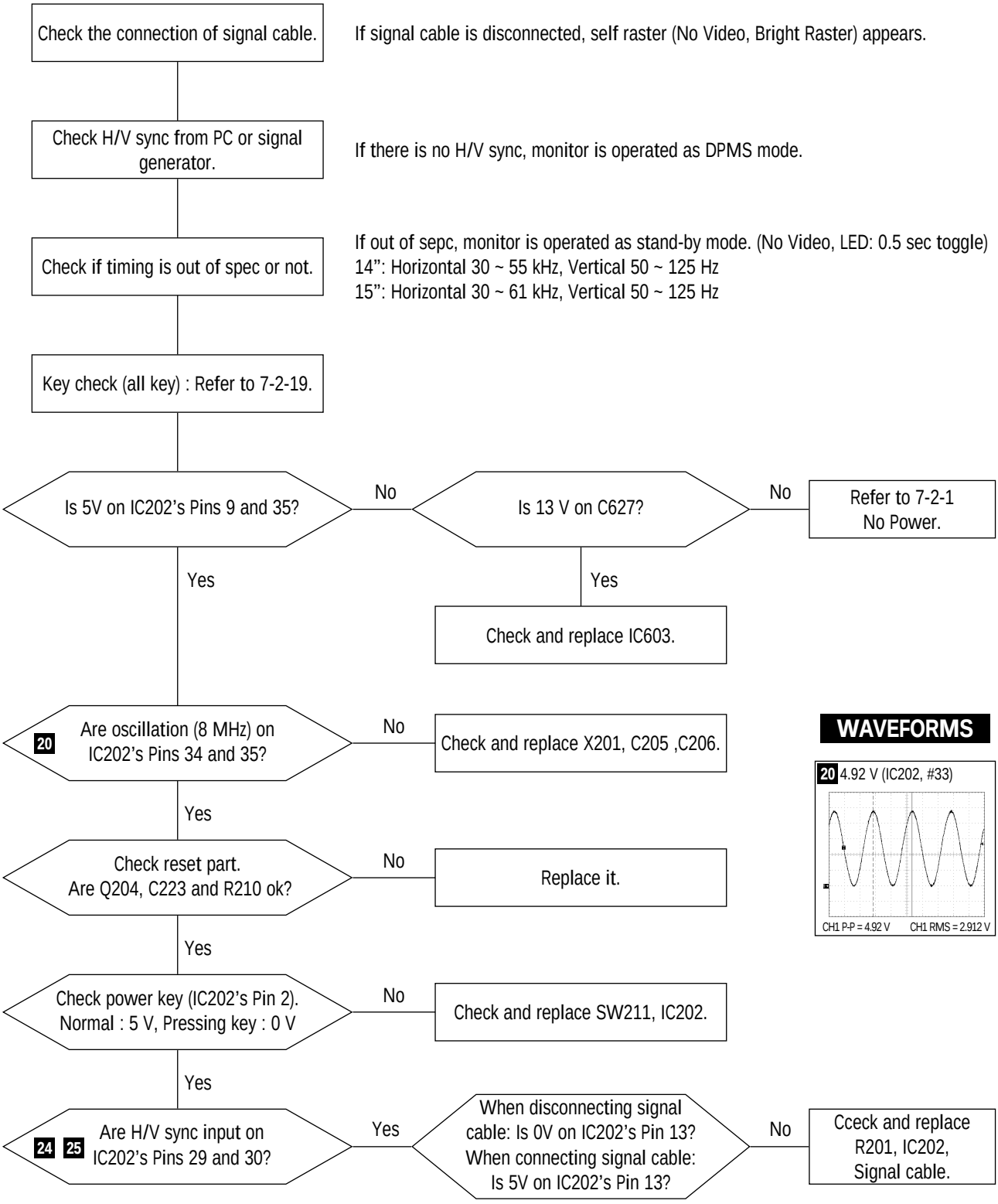






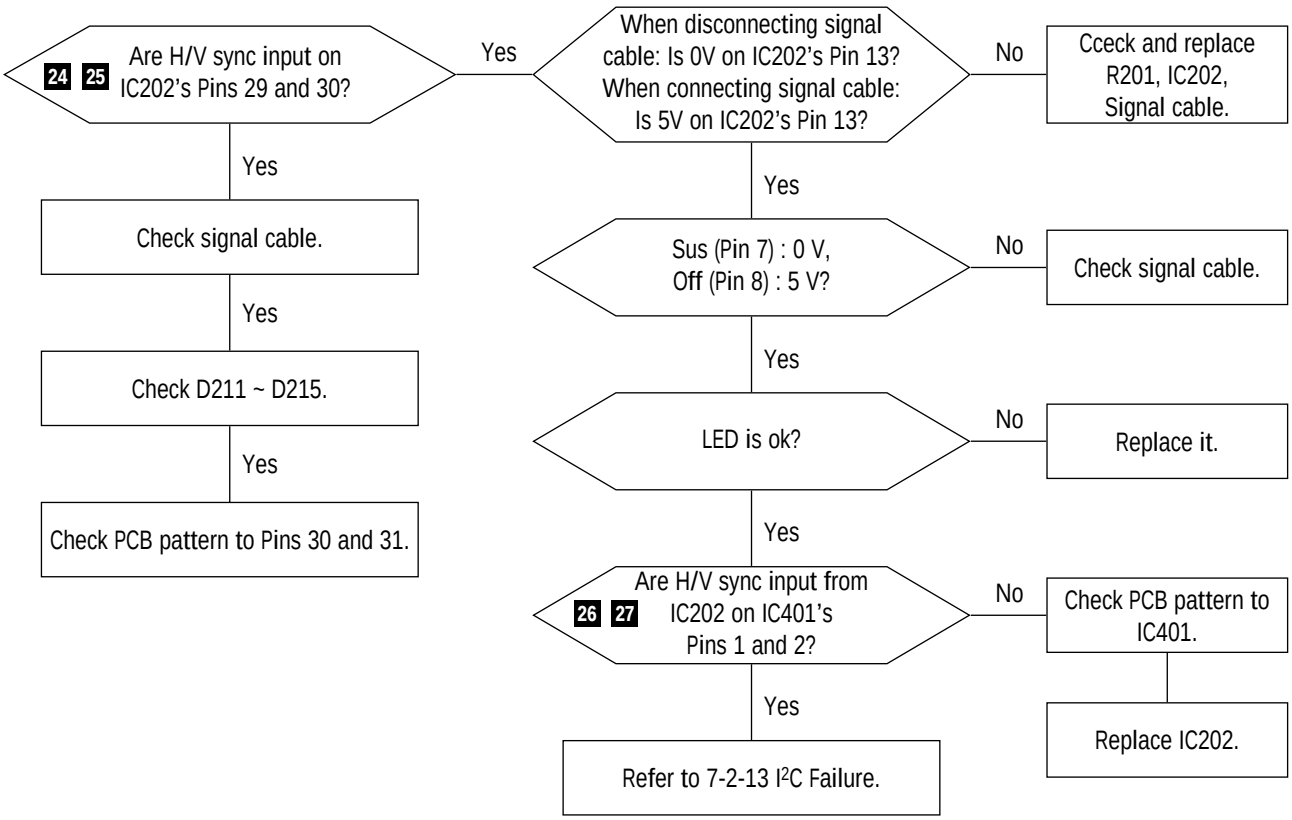


7-2-17 Micom Failure

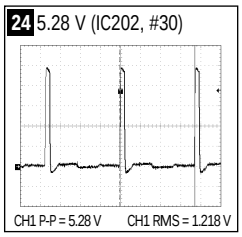

Check the connection of signal cable.
If signal cable is disconnected, self raster (No Video, Bright Raster) appears.
Check H/V sync from PC or signal generator.
If there is no H/V sync, monitor is operated as DPMS mode.
Check if timing is out of spec or not.
If out of sepc, monitor is operated as stand-by mode. (No Video, LED: 0.5 sec toggle)
14": Horizontal 30 ~ 55 kHz, Vertical 50 ~ 125 Hz
15": Horizontal 30 ~ 61 kHz, Vertical 50 ~ 125 Hz
Key check (all key) : Refer to 7-2-19.
Is 5V on IC202's Pins 9 and 35?
No
Is 13 V on C627?
No
Refer to 7-2-1 No Power.
Yes
Yes
Check and replace IC603.
20
Are oscillation (8 MHz) on IC202's Pins 34 and 35?
No
Check and replace X201, C205 ,C206.
Yes
Check reset part. Are Q204, C223 and R210 ok?
No
Replace it.
Yes
Check power key (IC202's Pin 2). Normal : 5 V, Pressing key : 0 V
No
Check and replace SW211, IC202.
Yes
24 25
Are H/V sync input on IC202's Pins 29 and 30?
Yes
When disconnecting signal cable: Is 0V on IC202's Pin 13? When connecting signal cable: Is 5V on IC202's Pin 13?
No
Cceck and replace R201, IC202, Signal cable.

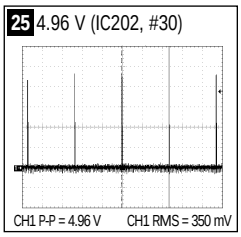
WAVEFORMS

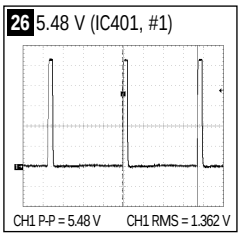
7-2-17 Micom Failure Continued

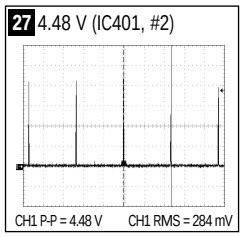

24 25 Are H/V sync input on IC202's Pins 29 and 30?
Yes
When disconnecting signal cable: Is 0V on IC202's Pin 13? When connecting signal cable: Is 5V on IC202's Pin 13?
No
Cceck and replace R201, IC202, Signal cable.
Yes
Check signal cable.
Yes
Sus (Pin 7) : 0 V, Off (Pin 8) : 5 V?
No
Check signal cable.
Yes
Check D211 ~ D215.
Yes
LED is ok?
No
Replace it.
Yes
Check PCB pattern to Pins 30 and 31.
Are H/V sync input from 26 27 IC202 on IC401's Pins 1 and 2?
No
Check PCB pattern to IC401.
Yes
Replace IC202.
Refer to 7-2-13 I²C Failure.

WAVEFORMS



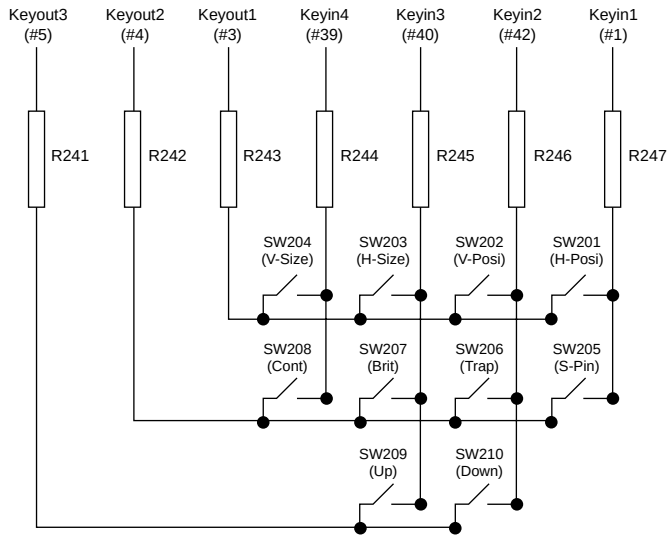






7-2-18 Key Check

1) Key Map



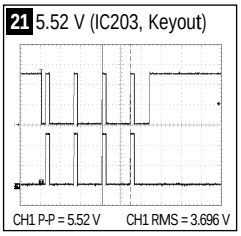
2) Voltage Check of Keyin and Keyout
   – Press the key what you want to check.
   – At that moment, the voltage of keyin and keyout that is connected with together should be changed as follows.

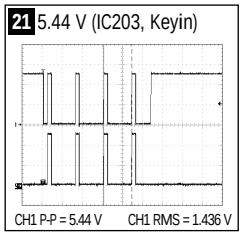
	Normal	Pressed	RMS voltage
Keyout	5 V	CH1 of Picture Pin 21	0.7 ~ 0.9 V
Keyin	0 V	CH2 of Picture Pin 21	0.7 ~ 0.9 V

3) LED Check
   – Pressing key, LED should be blinked.

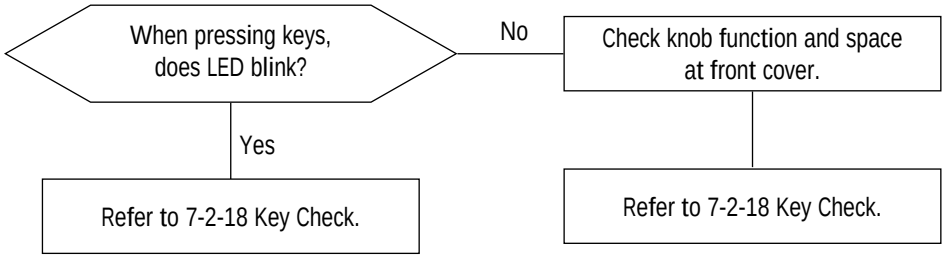
4) How to Repair?
   – If only one key has a key problem, replace that key.
   – But if some keys that are connected with same keyin or keyout line have problems, check and replace PCB pattern and IC202.

WAVEFORMS

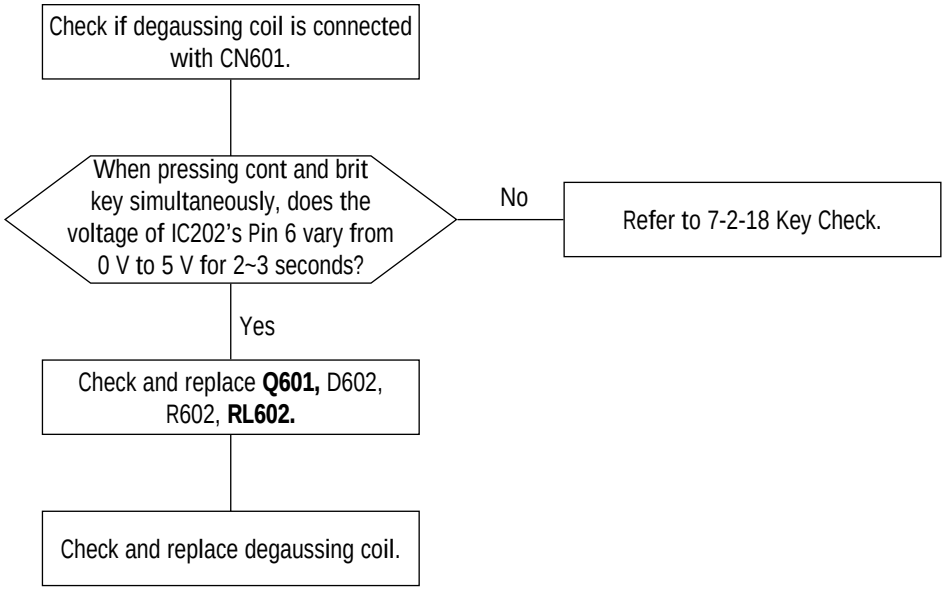




7-2-19 User Control Failure

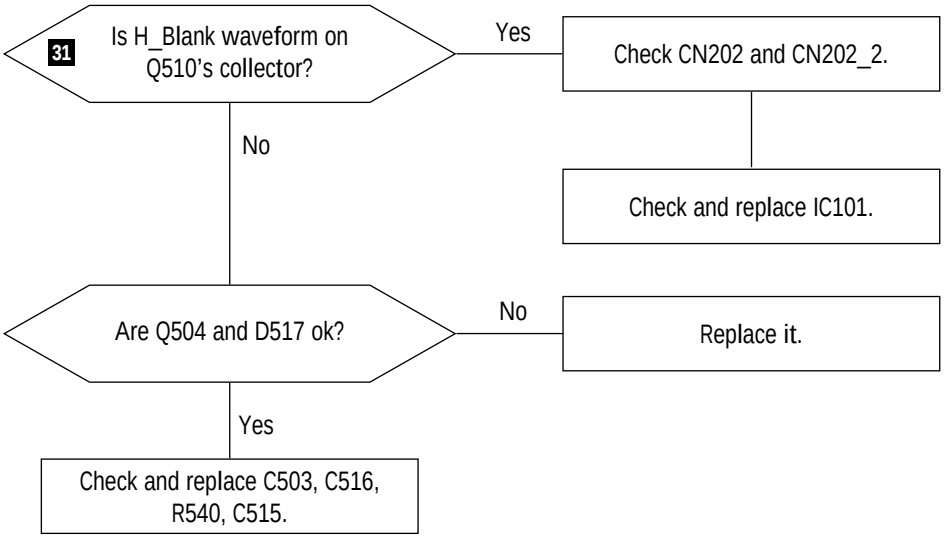

When pressing keys, does LED blink?
No
Check knob function and space at front cover.
Yes
Refer to 7-2-18 Key Check.
Refer to 7-2-18 Key Check.

7-2-20 Degaussing Failure

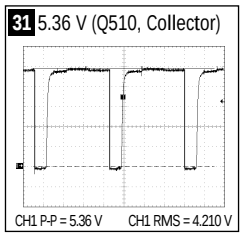

Check if degaussing coil is connected with CN601.
When pressing cont and brit key simultaneously, does the voltage of IC202's Pin 6 vary from 0 V to 5 V for 2~3 seconds?
No
Refer to 7-2-18 Key Check.
Yes
Check and replace **Q601,** D602, R602, **RL602.**
Check and replace degaussing coil.

7-2-21 Horizontal Blank Failure

Symptoms: – Dark image and if shifting image to left or right side, image is rolled.
– Raster left or right side is rolled.



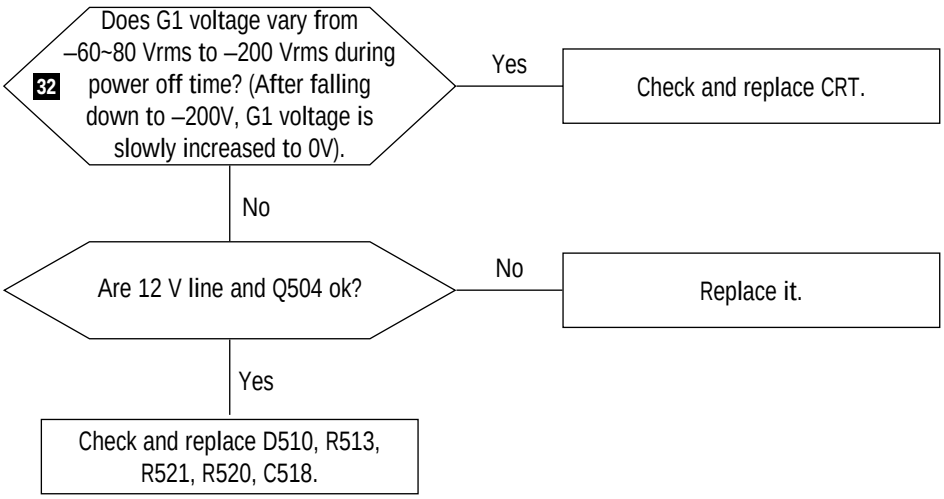
WAVEFORMS



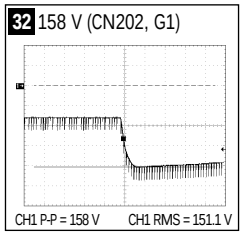
7-2-22 Whistle Sound

Check trans coil **(L401,** T501, T601, CRT)

7-2-23 Spot at Center During Power Off


Does G1 voltage vary from –60~80 Vrms to –200 Vrms during power off time? (After falling down to –200V, G1 voltage is slowly increased to 0V).
32
Yes
Check and replace CRT.
No
Are 12 V line and Q504 ok?
No
Replace it.
Yes
Check and replace D510, R513, R521, R520, C518.

WAVEFORMS



9 Electrical Parts List

9-1 Main PCB Parts

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
BD101			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD102			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD104			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD105			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD401			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD403			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD404			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD405			3301-000012	CORE-FERRITE BEAD	AA,3.5x1x9mm,1000,3000	
BD406			3301-000012	CORE-FERRITE BEAD	AA,3.5x1x9mm,1000,3000	
BD407			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD502			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD603			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD604			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD605			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD608			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD610			3301-000011	CORE-FERRITE BEAD	AA,3.5x1.0x5.7mm,1500	
BD611			3301-000012	CORE-FERRITE BEAD	AA,3.5x1x9mm,1000,3000	
C101B	287.3	134.5	2401-000028	C-AL	10uF,20%,50V,GP,5x11mm,5mm,TP	
C101G	281.0	134.5	2401-000028	C-AL	10uF,20%,50V,GP,5x11mm,5mm,TP	
C101R	277.5	137.0	2401-000028	C-AL	10uF,20%,50V,GP,5x11mm,5mm,TP	
C103B	295.3	200.0	2301-000010	C-FILM,PEF	100nF,5%,100V,11.5x12.5mm,5mm	
C103G	277.0	204.0	2301-000010	C-FILM,PEF	100nF,5%,100V,11.5x12.5mm,5mm	
C103R	295.3	236.3	2301-000010	C-FILM,PEF	100nF,5%,100V,11.5x12.5mm,5mm	
C104B	318.5	193.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C104G	323.8	216.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C104R	323.8	228.3	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C106B	323.5	141.3	2401-000043	C-AL	1uF,20%,160V,GP,6.3x11mm,5mm,T	
C106G	324.0	187.3	2401-000043	C-AL	1uF,20%,160V,GP,6.3x11mm,5mm,T	
C106R	315.0	186.8	2401-000043	C-AL	1uF,20%,160V,GP,6.3x11mm,5mm,T	
C107	258.0	229.8	2305-000004	C-FILM,MPEF	220nF,10%,100V,TP,12.7x16,5m	
C110	266.3	236.5	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C111	252.5	239.0	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	
C112	266.3	204.5	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C113	249.5	226.5	2401-000033	C-AL	100uF,20%,100V,GP,13x20mm,5mm	
C114	305.8	236.8	2401-000043	C-AL	1uF,20%,160V,GP,6.3x11mm,5mm,T	
C115	280.5	153.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C116	284.5	157.0	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	
C117	269.5	153.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C118	316.8	167.3	2201-000154	C-CERAMIC,DISC	10nF,+80-20%,2KV,Y5P,20x5,10,T	⚠
C119	265.0	166.5	2201-000019	CAP-CERAMIC,103Z,2H,DISC	10NF,500V,80-20%,Y5V,RADIAL	
C120	292.8	153.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C121	275.0	153.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C122	269.0	226.0	2201-000502	C-CERAMIC,DISC	39pF,5%,50V,NPO,5x3.5,5,TP	
C123	288.0	137.8	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C124	293.5	134.5	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
C125	253.3	188.3	2201-000021	C-CERAMIC,DISC	100nF,+80-20%,50V,Y5V,8x3,5,TP	
C126	323.5	174.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C127	304.8	137.3	2401-000027	C-AL	4.7uF,20%,50V,GP,5x11mm,5mm,TP	
C201	44.3	93.3	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	
C203	51.3	75.5	2201-000017	C-CERAMIC,DISC	1nF,10%,50V,Y5P,4x3.5,5,TP	
C204	47.8	75.5	2201-000146	C-CERAMIC,DISC	100pF,5%,50V,SL,5x3.5,5,TP	
C205	44.3	75.5	2201-000009	C-CERAMIC,DISC	22pF,5%,50V,NPO,4x3.5,5,TP	
C206	40.5	75.5	2201-000397	C-CERAMIC,DISC	24pF,5%,50V,CH,TP,5.0x3.0	
C207	70.5	31.0	2401-000050	C-AL	10uF,20%,16V,GP,5x11mm,2mm,TP	
C208			2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5	
C210	58.0	43.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C211	55.3	43.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C212			2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	TILT OPTION
C219	210.5	102.3	2201-000011	C-CERAMIC,DISC	47pF,5%,50V,NPO,6.5x3.0,5,TP	
C220	77.8	85.8	2401-000050	C-AL	10uF,20%,16V,GP,5x11mm,2mm,TP	
C221	33.8	42.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C222	68.8	13.5	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	
C223	33.8	109.5	2401-000027	C-AL	4.7uF,20%,50V,GP,5x11mm,5mm,TP	
C301	110.0	91.3	2305-001009	C-FILM,MPEF	39nF,5%,250V,13x9x4.5mm,7.5mm	
C304	107.0	73.5	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	
C305	106.5	41.8	2305-000280	(T)63V 224K	CAP-MPETP,224K,1J,5P	
C306	140.8	41.3	2401-000039	C-AL	1000uF,20%,16V,GP,10x16mm,5mm	
C307	106.0	66.3	2401-000849	(T)35V 220M	CAP-AL.ELEC,227M,1V	
C309	102.5	54.0	2201-000013	C-CERAMIC,DISC	470pF,10%,50V,Y5P,4x3.5,5,TP	
C310	106.5	56.5	2301-000012	(T)100V 222J	CAP-MYLAR,222J,2A,5P	
C311	101.5	50.1	2301-000015	C-FILM,PEF	10nF,5%,100V,7x3.2x7mm,5mm,TP	
C312			2305-000001	C-FILM,MPEF	470nF,10%,63V,TP,6.0X15.5X7	TILT OPTION
C401	49.0	142.3	2401-000027	C-AL	4.7uF,20%,50V,GP,5x11mm,5mm,TP	
C402	54.0	143.3	2305-000280	C-FILM,MPEF	220nF,10%,63V,TP,7.5x13.5mm	
C403	52.3	134.3	2301-000174	C-FILM,PEF	15nF,5%,100V,7.2x4.0x7.5mm,5mm	
C404	63.0	142.3	2401-000031	C-AL	47uF,20%,16V,GP,6.3x11mm,5mm,T	
C405	63.5	134.3	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C406	57.8	137.3	2301-000257	C-FILM,PEF	4.7nF,10%,100V,5.8x12.5mm,5mm	
C407	69.0	142.5	2201-000471	C-CERAMIC,DISC	330pF,10%,50V,Y5P,4x3.5,5,TP	⚠
C408	48.0	130.8	2301-000016	C-FILM,PEF	22nF,5%,100V,7.2x4.5x9.0mm,5mm	
C409	42.8	136.5	2202-002021	C-CERAMIC,MLC-RADIAL	1nF,5%,50V,NPO,TP,5.1x6.4x3.2	
C410	76.5	208.5	2201-000291	C-CERAMIC,DISC	1nF,10%,500V,Y5P,8.5x5MM,5,TP	
C411	100.0	228.5	2401-000876	(T)50V 220M	CAP-AL.ELEC,227M,1H	
C412	82.0	199.3	2401-000048	(T)25V 47M	CAP-AL.ELEC,476M,1E	
C413	71.8	179.0	2301-000012	(T)100V 222J	CAP-MYLAR,222J,2A,5P	
C414	111.8	237.8	2301-001207	C-FILM,PPF	5.2nF,5%,2.5KV,BK,29x21.5x13.	15" ⚠
C414			2303-000282	C-FILM,PPF	6nF,5%,1.6KV,TP,29*23*8.5,20m	14" ⚠
C415	36.5	143.8	2201-000011	C-CERAMIC,DISC	47pF,5%,50V,NPO,6.5x3.0,5,TP	
C416	162.5	241.0	2401-000028	C-AL	10uF,20%,50V,GP,5x11mm,5mm,TP	
C417	132.8	229.0	2301-000133	C-FILM,PEF	10nF,10%,100V,6.5x12.5mm,5mm,T	
C418	177.0	241.0	2401-000028	C-AL	10uF,20%,50V,GP,5x11mm,5mm,TP	
C420	48.0	180.5	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
C421	75.0	137.5	2201-000643	C-CERAMIC,DISC	680pF,10%,50V,Y5P,4x3.5,5,TP	
C422	43.8	218.3	2306-000137	C-FILM,MPPF	180nF,5%,250V,TP,19x16.5x8,7	15”
C422			2306-000171	C-FILM,MPPF	270nF,5%,250V,TP,21.5x12.5mm	14”
C423	55.5	218.0	2301-001162	C-FILM,MPPF	370nF,5%,250V,TP,19x18.5x12.5	15”
C423			2301-001125	C-FILM,MPPF	600nF,5%,250V,TP,26x20x11.5,	14”
C424	33.5	211.0	2301-001125	C-FILM,MPPF	600nF,5%,250V,TP,26x20x11.5,20	15”
C424			2306-000249	C-FILM,MPPF	680nF,5%,250V,TP,26x20.5x12	14”
C425	36.3	161.3	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	
C427	60.0	167.3	2301-000168	C-FILM,PEF	150nF,5%,100V,11.5x19mm,7.5mm	
C428	26.0	222.5	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	
C429	15.5	222.5	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	
C430	61.5	161.0	2305-000001	C-FILM,MPEF	470nF,10%,63V,6.0X15.5X7.5,5mm	
C431	36.3	168.5	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	
C434	72.8	168.5	2401-001509	C-AL	47uF,20%,16V,GP,6.3x7mm,2.5mm	
C435	151.8	122.0	2401-001012	C-ALUMINUM	3.3UF,20%,50V,BP,16+26.7,7.5mm,T	
C436	129.0	188.0	2303-001029	C-FILM,PPF	5.2nF,5%,630V,19x7x13,7.5,TP	
C437	155.5	147.0	2301-000012	(T)100V 222J	CAP-MYLAR,222J,2A,5P	
C439	158.8	137.8	2201-000010	CAP-CERAMIC,330J,1H,NPO	33PF,50V,5%,NPOPPM,NPO,DISC-RAD	
C440	77.5	132.3	2301-000016	C-FILM,PEF	22nF,5%,100V,7.2x4.5x9.0mm,5mm	
C441	185.0	135.5	2301-000012	(T)100V 222J	CAP-MYLAR,222J,2A,5P	
C442	81.0	115.0	2201-000326	C-CERAMIC,DISC	2.2nF,10%,50V,Y5P,6.3X3.0,5,TP	
C443	37.5	137.3	2301-000016	C-FILM,PEF	22nF,5%,100V,7.2x4.5x9.0mm,5mm	
C445	50.5	172.3	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C501	92.5	167.0	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C502	103.0	147.3	2401-000966	C-AL	22uF,20%,50V,GP,6.3x11mm,5mm,T	
C503	191.0	136.3	2201-000017	C-CERAMIC,DISC	1nF,10%,50V,Y5P,4x3.5,5,TP	
C504	85.5	174.5	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C505	110.8	159.3	2305-000004	C-FILM,MPEF	220nF,10%,100V,12.7x16,5mm,TP	
C506	77.3	31.0	2401-000050	C-AL	10uF,20%,16V,GP,5x11mm,2mm,TP	
C507	219.0	205.3	2201-000017	C-CERAMIC,DISC	1nF,10%,50V,Y5P,4x3.5,5,TP	
C508	207.5	144.5	2401-000046	(T)250V 10M	CAP-AL.ELEC,106M,2E	
C509	194.8	241.0	2401-001334	C-AL	470nF,20%,50V,GP,5x11mm,2mm,TP	
C511	118.5	149.3	2201-000469	C-CERAMIC,DISC	330pF,10%,500V,Y5P,6x3.5,5,TP	
C512	130.0	137.5	2306-000007	C-FILM,MPPF	470nF,5%,250V,26.5x14mm,22.5mm	
C515	186.8	125.8	2201-000017	C-CERAMIC,DISC	1nF,10%,50V,Y5P,4x3.5,5,TP	
C516	186.8	129.5	2201-000471	C-CERAMIC,DISC	330pF,10%,50V,Y5P,4x3.5,5,TP	
C517	155.5	87.5	2401-000373	C-AL	100uF,20%,63V,GP,10x20mm,5mm,T	
C518	174.8	137.5	2401-000027	C-AL	4.7uF,20%,50V,GP,5x11mm,5mm,TP	
C519	234.3	165.3	2401-000010	C-AL	220uF,20%,16V,GP,6.3x11mm,2.5m	
C520	214.3	224.5	2202-002008	C-CERAMIC,MLC-AXIAL	10nF,+80-20%,50V,Y5V,2.3X3.0	⚠
C601	34.0	13.5	2401-000039	C-AL	1000uF,20%,16V,GP,10x16mm,5mm	
C604	263.5	62.8	2201-000023	C-CERAMIC,DISC	2.2nF,20%,125V,Y5U,11x7,5,TP	⚠
C605	269.0	45.3	2201-000023	C-CERAMIC,DISC	2.2nF,20%,125V,Y5U,11x7,5,TP	
C606	267.5	36.5	2301-001156	C-FILM,MPEF	220nF,10%,275V,BK,26x18x8.5,22	
C610	168.0	14.0	2301-000012	(T)100V 222J	CAP-MYLAR,222J,2A,5P	
C611	176.3	23.3	2301-000287	(T)100V 562J	CAP-MYLAR,562J,2A,5P	⚠
C612	138.0	87.5	2401-000887	C-AL	220uF,20%,63V,GP,10x20mm,5mm,T	⚠

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
C613	229.3	15.0	2301-000018	C-FILM,PEF	47nF,5%,100V,8.5x12.5mm,5mm,TP	⚠
C614	224.3	15.0	2301-000018	C-FILM,PEF	47nF,5%,100V,8.5x12.5mm,5mm,TP	
C615	146.8	22.8	2401-000039	C-AL	1000uF,20%,16V,GP,10x16mm,5mm	⚠
C617	245.8	91.8	2401-003119	C-AL	150uF,20%,400V,GP,25.4x30,10mm	⚠
C618	248.8	17.8	2201-000019	CAP-CERAMIC,103Z,2H,DISC	10NF,500V,80-20%,Y5V,RADIAL	⚠
C619			2202-002008	C-CERAMIC,MLC-AXIAL	10nF,+80-20%,50V,Y5V	M/M Option
C620	162.5	22.5	2401-000032	C-AL	100uF,20%,50V,GP,10x16mm,5mm,T	⚠
C621	162.5	57.0	2201-000291	C-CERAMIC,DISC	1nF,10%,500V,Y5P,8.5x5MM,5,TP	
C622			2401-000151	C-AL	1000uF,20%,25V,GP,TP,10x20mm,5	M/M Option
C623	253.5	68.5	2401-001195	(T)50V 33M	CAP-AL.ELEC,336M,1H	⚠
C624	245.0	56.3	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	⚠
C625	251.5	36.8	2201-000012	C-CERAMIC,DISC	220pF,10%,1KV,Y5P,6.3x5,5,TP	⚠
C626	232.0	73.0	2401-000023	(T)50V 1M	CAP-AL.ELEC,105M,1H	⚠
C627	176.0	53.5	2401-000039	C-AL	1000uF,20%,16V,GP,10x16mm,5mm	⚠
C628	26.5	173.8	2202-002009	C-CERAMIC,MLC-AXIAL	100nF,+80-20%,50V,Y5V,2.3X3.0	
C629	48.0	187.3	2401-000042	C-AL	100uF,20%,16V,GP,6.3x7mm,2.5mm	
C630	202.8	74.0	2201-000023	C-CERAMIC,DISC	2.2nF,20%,125V,Y5U,11x7,5,TP	
C632	160.5	42.5	2401-000039	C-AL	1000uF,20%,16V,GP,10x16mm,5mm	⚠
C633	149.0	54.8	2401-000031	C-AL	47uF,20%,16V,GP,6.3x11mm,5mm,T	⚠
C634	217.3	72.5	2301-000010	C-FILM,PEF	100nF,5%,100V,11.5x12.5mm,5mm	
C635	214.3	14.5	2201-000023	C-CERAMIC,DISC	2.2nF,20%,125V,Y5U,11x7,5,TP	
C637	21.8	187.0	2401-000913	C-AL	22uF,20%,16V,GP,TP,5x11,5	
C638	239.3	17.5	2201-000023	C-CERAMIC,DISC	2.2nF,20%,125V,Y5U,11x7,5,TP	
CN102	265.0	179.5	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN103	317.5	161.3	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN201	224.0	115.8	3711-003895	CONNECTOR-HEADER	BOX,13P,1R,2mm,STRAIGHT,SN	
CN202	224.0	124.3	BH39-40365H	CBF-HARNESS	15P,200MM,WHT/BLK/RED/BLU,UL10	
CN301	118.5	184.5	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN302	118.5	176.5	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN303	91.5	13.5	3711-000197	CONNECTOR-HEADER	1WALL,3P,1R,2.5mm,STRAIGHT,SN (MPR II)	TILT OPTION
CN502	118.5	203.0	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN503	118.5	192.5	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	⚠
CN504	188.0	238.0	3711-000024	CONNECTOR-HEADER	BOX,3P,1R,2.5mm,STRAIGHT,SN	
CN601	305.0	97.0	3711-000217	STRAIGHT,1WALL	CON-WALL HEADER,3P,3.96	
CN602	271.3	77.8	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN603	263.8	77.8	BH71-40300A	PIN-HINGE	BRASS,D2.36,SN,HEAT/SINK	
CN605			3722-000110	JACK-DC POWER	1P,NI,BLACK	M/M Option
D103B	309.8	207.3	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D103G	309.5	219.8	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D103R	309.0	231.0	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D-COIL	325.2	118.5	BH27-10336B	COIL-DEGAUSSING	255*255*1020MM,7.0MH,21.3OHM,8	
D205	228.5	130.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D206	231.0	130.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D207	233.5	130.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D208	237.5	126.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D209	237.5	124.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
D210	237.5	121.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D211	214.5	108.0	0403-000005	0.5W,10MA	DIODE-ZEN,UZ-5.1B,DO-35	
D212	227.5	109.6	0403-000005	0.5W,10MA	DIODE-ZEN,UZ-5.1B,DO-35	
D213	227.5	107.0	0403-000005	0.5W,10MA	DIODE-ZEN,UZ-5.1B,DO-35	
D214	259.5	117.3	0403-000005	0.5W,10MA	DIODE-ZEN,UZ-5.1B,DO-35	
D215	259.5	114.8	0403-000005	0.5W,10MA	DIODE-ZEN,UZ-5.1B,DO-35	
D216	69.0	134.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D301	130.5	41.0	0402-000128	70V,1A,1.1V,1A,2000NS,0.5A	DIODE-REC,1N4002,DO-41	
D401	81.5	212.8	0402-000007	420V,1A,1.2V,1A,200NS,1A	DIODE-REC,1N4937,DO-41	
D402	172.3	230.3	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D403	135.5	207.8	0402-001200	DIODE-RECTIFIER	SDS04U150S,1500V,4A,TO-220F,ST	
D404	162.3	220.8	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D405	75.3	178.5	0402-000128	70V,1A,1.1V,1A,2000NS,0.5A	DIODE-REC,1N4002,DO-41	
D406	27.8	206.1	0402-000006	DIODE-RECTIFIER	1N4007GP,1000V,1A,DO-41	
D407	16.0	206.0	0402-000006	DIODE-RECTIFIER	1N4007GP,1000V,1A,DO-41	
D408	121.0	234.3	0402-001112	DIODE-RECTIFIER	MDV04-600,600V,4A,DO-201	
D409	127.3	234.3	0402-001025	DIODE-RECTIFIER	ERD07-15,1500V,1.5A	
D411	61.0	188.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D412	60.8	134.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D413	58.3	126.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D414	135.5	186.0	0402-001118	DIODE-RECTIFIER	UF1G,400V,1.2A,DO-204AL,TP	
D415	66.5	134.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D501	116.5	134.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D503	96.3	150.8	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D505	96.3	156.3	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D507	213.0	156.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D509	210.5	156.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D510	217.5	183.0	0402-000006	DIODE-RECTIFIER	1N4007GP,1000V,1A,DO-41	
D513	212.8	137.8	0401-000006	DIODE-SWITCHING	BAV21,200V,250mA,400mW,50nS,DO	
D514	181.8	233.5	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D515	118.5	152.5	0402-000014	DIODE-RECTIFIER	RG2,400V,1.2A,DO-201	
D517	190.0	125.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D518	202.0	235.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D519	96.3	158.8	0403-000753	DIODE-ZENER	MTZJ27D,27V,26.29-27.64V,500mW	
D602	277.3	117.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D604	293.5	79.0	0402-001111	DIODE-RECTIFIER	1N5397GP,600V,1.5A,DO-204AC,TP	
D605	260.0	58.0	0402-001111	DIODE-RECTIFIER	1N5397GP,600V,1.5A,DO-204AC,TP	⚠
D606	260.0	51.3	0402-001111	DIODE-RECTIFIER	1N5397GP,600V,1.5A,DO-204AC,TP	⚠
D607	286.5	75.3	0402-001111	DIODE-RECTIFIER	1N5397GP,600V,1.5A,DO-204AC,TP	⚠
D608	173.0	27.5	0402-000007	420V,1A,1.2V,1A,200NS,1A	DIODE-REC,1N4937,DO-41	
D609	220.5	20.0	0403-000351	DIODE-ZENER	UZ4.7B,4.7V,4.4-5.0V,500mW,DO-	
D611	185.0	31.0	0402-000007	420V,1A,1.2V,1A,200NS,1A	DIODE-REC,1N4937,DO-41	
D612			0402-000016	DIODE-RECTIFIER	UF5404,400V,3A,DO-201AD	M/M Option
D613	222.5	33.3	0402-000012	DIODE-RECTIFIER	UF4007,1KV,1A,DO-41	⚠
D614	222.5	54.3	0402-000546	DIODE-RECTIFIER	TVR10G,400V,1.0A,DO-41	⚠
D615	186.0	61.5	0402-000005	DIODE-RECTIFIER	31DF4,400V,3A,DO-201AD	
D616	185.0	38.3	0402-001118	DIODE-RECTIFIER	UF1G,400V,1.2A,DO-204AL,TP	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
D617	185.0	42.5	0402-001190	DIODE-RECTIFIER	RG10Z,200V,1.2A,DO-15,TP	
D618	231.2	80.0	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	⚠
D619	256.8	44.8	0402-000017	DIODE-RECTIFIER	RGP02-12,1200V,0.5A,DO-204AL	⚠
D620	170.0	58.0	0402-000007	420V,1A,1.2V,1A,200NS,1A	DIODE-REC,1N4937,DO-41	
D621	29.3	184.3	0401-000005	75V,150MA,1V,10MA	DIODE-SIG,1N4148,DO-35	
D622	33.0	184.3	0403-000007	DIODE-ZENER	UZ6.2BM,6.2V,6.0-6.4V,500mW,DO	
D623	35.5	176.3	0403-000007	DIODE-ZENER	UZ6.2BM,6.2V,6.0-6.4V,500mW,DO	
F602			3601-001092	FUSE-FERRULE	125V,2.5A,SLOW-BLOW,EPOXY,7	M/M Option
FG601	295.0	10.0	3601-000004	FUSE-FERRULE	250V,3.15A,SLOW BLOW,CERAMIC,5	⚠
FH601	305.3	9.8	3602-000001	800GF,400-800GF	FUSE-CLIP,5.2X20,30MOHM	
HS102	280.5	221.0	BH62-30410A	HEAT/SINK	A6063S,T2.5,-,CGH7609	
HS301	120.0	47.0	BH62-30411A	HEAT/SINK	A6063S,T2.0,CGH7609	
HS501	138.0	237.0	BH62-30417A	HEAT/SINK-FBT	A1050S,T1.0,CKA4227/CAK5227	
HS508	113.3	147.5	BH62-30015A	HEAT/SINK-TR	SCP-1,T1,SN,CVM4967,3111	
HS602	237.6	44.0	BH62-30411A	HEAT/SINK	A6063S,T2.0,CGH7609	⚠
IC101	273.5	141.0	1201-001315	IC-VIDEO AMP	2504,DIP,24P,300MIL,SINGLE,P	⚡
IC102	289.0	241.0	BH13-10335W	IC-HYBRID	CHA5807,LM2409,SIP,11P,CRT DRI	⚡
IC201			3704-001071	SOCKET-IC	42P,DIP,SN,1.778mm	SOCKET
IC202	34.0	48.5	0903-001112	IC-MICROCONTROLLER	88P6116,8BIT,DIP,42P,600MIL,12	
IC203	62.5	13.3	1103-001104	IC-EEPROM	24C020,256x8BIT,DIP,8P,300MIL	
IC204	63.5	121.8	1103-001009	IC-EEPROM	24LC21,128X8BIT,DIP,8P,300MIL	⚡
IC301	112.0	50.8	1204-000013	IC-VERTICAL PROCESSO	TDA9302H,TO-220,9P,PLASTIC,3	
IC302			1201-001323	IC-OP AMP	334,DIP,8P,300MIL,DUAL,PLAST	TILT OPTION
IC401	40.0	146.8	1204-001231	IC-DEF. PROCESSOR	TDA9109,DIP,32P,300MIL,PLASTIC	⚡
IC601	181.8	9.5	1203-000002	TO-92,3,36V(T)-SIMPLE	IC-LIN,431,REGULATOR	
IC602	246.0	38.0	BH13-10335J	IC-HYBRID	CKA5227,KA2S0680,SIP,5P,FET+CO	⚠
IC603	46.8	8.3	1203-000001	IC-POSI.ADJUST REG.	7805,TO-220,3P,PLASTIC,4.8/5	
IS601	303.3	29.0	3721-001006	PLUG-AC POWER	3P,10/24mm,SN	⚠
L101B	285.3	205.3	2701-001036	INDUCTOR-AXIAL	1.2uH,10%,9.8x4.2mm	
L101G	268.8	213.0	2701-001036	INDUCTOR-AXIAL	1.2uH,10%,9.8x4.2mm	
L101R	302.8	230.0	2701-001036	INDUCTOR-AXIAL	1.2uH,10%,9.8x4.2mm	
L401	104.3	212.0	BH27-20344K	COIL-HOR LINEARITY	6.2UH,20%,DR14*15,BULK	
L401			BH27-20344A	COIL-HOR LINEARITY	5.7UH,20%,DR14*15,BUL	Delete
L402	137.5	133.0	BH27-20344Y	COIL-CHOKE	170UH,10%,DR12*15,BULK	
L403	36.5	126.3	2701-000154	INDUCTOR-AXIAL	220uH,10%,4.2x9.8mm	
L501	110.5	117.3	BH27-20342V	COIL-CHOKE	200UH,15%,DR14*20,BULK	
L502	85.3	225.5	BH27-20342U	COIL-CHOKE	7.1MH,10%,DR8*11,BULK	
L503	194.3	119.8	2701-000154	INDUCTOR-AXIAL	220uH,10%,4.2x9.8mm	
L504	196.8	225.0	2701-001036	INDUCTOR-AXIAL	1.2uH,10%,9.8x4.2mm	15", Delete
L504			BH39-40305U	CBF-HARNESS	52MM,AWG22(0.6PI)	14"
L601	279.8	55.8	BH27-20022A	COIL-LINE FILTER	0.3OHM,B,1UEW0.40,5T,3	
L602	264.3	27.0	BH26-30008A	TRANS-LINE FILTER	15MH,8P,EE,SB-5S,15MH,EE-222	⚠
OP201	14.3	31.8	0601-001147	LED	ROUND,GRN,4.75mm,565nm	
OP601	199.5	17.5	0604-001018	PHOTO-COUPLER	DAR-TR,63-125%,200mW,DIP-4,ST	⚠
PCB1415	325.0	105.3	BH41-10345A	PCB-MAIN	HA-CHASSIS,FR-1,1L,247*330mm,1	
Q101B	324.8	177.5	0501-000412	TR-SMALL SIGNAL	KSP42,NPN,625mW,TO-92,40	
Q101G	320.5	177.0	0501-000412	TR-SMALL SIGNAL	KSP42,NPN,625mW,TO-92,40	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
Q101R	316.3	177.5	0501-000412	TR-SMALL SIGNAL	KSP42,NPN,625mW,TO-92,40	
Q102B	319.5	205.3	0501-000416	TR-SMALL SIGNAL	KSP92,PNP,625mW,TO-92,25	
Q102G	319.5	218.8	0501-000416	TR-SMALL SIGNAL	KSP92,PNP,625mW,TO-92,25	
Q102R	319.5	231.0	0501-000416	TR-SMALL SIGNAL	KSP92,PNP,625mW,TO-92,25	
Q201	16.0	12.0	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q203	71.3	18.5	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q204	35.3	88.3	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q301	104.5	84.3	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q402	134.3	174.3	0502-001129	TR-POWER	KSC5802,NPN,70W,TO-3PF,ST,5-	
Q403	68.5	198.0	0501-000369	TR-SMALL SIGNAL	TR-NPN,KSC2331-Y,TO-92L,ECB	
Q404	23.0	229.5	0505-001129	FET-SILICON	IRF630A,N,200V,10uA,400mohm,72	
Q405	15.0	228.8	0505-001102	FET-SILICON	IRFR/U230A,N,200V,7.5A,400mohm	
Q406	44.5	198.5	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q407	55.5	200.3	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q408	154.5	132.8	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q409	163.0	132.8	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q410	171.8	148.8	0503-000001	TR-DARLINGTON	KSE800, NPN,60V,60V,4A,40W,TO-126	
Q411	158.5	228.5	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q412	153.3	228.5	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q501	209.5	232.0	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q502	214.0	227.5	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q504	169.5	132.8	0501-000143	TR-SMALL SIGNAL	2N6520,PNP,625mW,TO-92,30-20	
Q506	219.0	221.5	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q507	101.5	177.8	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q508	109.3	150.0	0505-000011	FET-SILICON	IRF630,N,200V,9A,0.4ohm,75W	
Q509	101.5	173.0	0501-000303	TR-SMALL SIGNAL	KSA733-Y,PNP,250mW,TO-92,120	
Q510	201.5	132.5	0501-000122	TR-SMALL SIGNAL	2N3904,NPN,625mW,TO-92,100-3	
Q601	267.3	117.5	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q602	32.8	198.0	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q603	144.8	63.5	0501-000321	TR-SMALL SIGNAL	KSB1116-Y,PNP,0.75W,TO-92,13	
Q604	149.8	74.3	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q605	31.3	187.3	0501-000321	TR-SMALL SIGNAL	KSB1116-Y,PNP,0.75W,TO-92,13	
Q606	32.8	193.3	0501-000586	0.25W,60V,50V,5V,0.15A	TR-NPN,KSC945,TO-92,EBC	
Q607			0502-000249	KSB772-Y		M/M Option
Q608			0501-000586	TR-SMALL SIGNAL	KSC945,NPN,250mW,TO-92,T	M/M Option
R102B	260.5	134.0	2001-000665	R-CARBON	33ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R102G	260.5	131.5	2001-000665	R-CARBON	33ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R102R	260.5	129.0	2001-000665	R-CARBON	33ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R103B	256.8	138.5	2001-000025	R-CARBON	75ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R103G	254.0	138.5	2001-000025	R-CARBON	75ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R103R	251.3	138.5	2001-000025	R-CARBON	75ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R104B	285.3	227.0	2001-000021	R-CARBON	27ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R104G	282.3	227.0	2001-000021	R-CARBON	27ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R104R	288.3	227.0	2001-000021	R-CARBON	27ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R105B	320.5	196.5	2001-000962	R-CARBON	75Kohm,5%,1/4W,AA,TP,2.4x6.4mm	
R105G	320.5	216.3	2001-000962	R-CARBON	75Kohm,5%,1/4W,AA,TP,2.4x6.4mm	
R105R	320.5	233.8	2001-000962	R-CARBON	75Kohm,5%,1/4W,AA,TP,2.4x6.4mm	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
R106	251.5	198.8	2001-000042	R-CARBON	1Kohm,5%,1/4W,AA,TP,2.4x6.4mm	
R107B	303.3	204.0	2001-000028	R-CARBON(S)	100ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R107G	262.8	175.0	2001-000028	R-CARBON(S)	100ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R107R	310.0	183.0	2001-000028	R-CARBON(S)	100ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R108B	309.5	201.8	2001-000530	R-CARBON	240Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R108G	309.5	222.3	2001-000530	R-CARBON	240Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R108R	309.5	236.5	2001-000530	R-CARBON	240Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R110	262.8	149.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R110B	309.5	210.0	2001-000047	R-CARBON	2.2Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R110G	309.5	212.8	2001-000047	R-CARBON	2.2Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R110R	309.5	225.3	2001-000047	R-CARBON	2.2Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R111	265.3	149.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R112	249.3	219.3	2001-000835	R-CARBON	51Kohm,5%,1/4W,AA,TP,2.4x6.4mm	
R113	269.0	240.0	2001-000317	R-CARBON	120Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R113B	297.5	151.3	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R113G	296.5	153.8	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R113R	296.5	156.3	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R114	285.0	167.3	2001-000511	R-CARBON	220ohm,5%,1/2W,AA,TP,3.3x9mm	
R115	256.3	165.0	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R116	267.0	153.0	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R117	277.8	153.0	2001-000039	R-CARBON	390ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R118	272.3	153.0	2001-000039	R-CARBON	390ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R119	290.3	153.0	2001-000039	R-CARBON	390ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R121	315.5	135.4	2001-000108	R-CARBON	18Kohm,5%,1/8W,AA,TP,1.8x3.2mm	
R201	52.0	32.0	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R202	40.3	72.0	2001-000097	R-CARBON	1Mohm,5%,1/6W,AA,TP,1.8x3.2mm	
R210	39.5	104.3	2001-001070	R-CARBON(S)	120ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R211	35.5	101.8	2001-000051	R-CARBON	2.7Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R212	49.5	31.5	2001-000562	R-CARBON	27Kohm,5%,1/6W,AA,TP,1.8x3.2mm	Delete
R213	56.5	70.0	2001-000856	R-CARBON	560ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R214	54.0	70.0	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R215	65.5	32.0	2001-000108	R-CARBON	18Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R216			2001-000067	R-CARBON	10Kohm,5%,1/8W(1/6W),AA,TP,1.8	TILT OPTION
R219	169.3	107.0	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	
R221	34.8	73.5	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R222	29.5	60.0	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R223	65.0	68.5	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R224	67.5	68.5	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R226	51.3	93.3	2001-000040	R-CARBON	470ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R227	43.0	101.3	2001-000077	R-CARBON	47Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R228	45.5	101.3	2001-000077	R-CARBON	47Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R229	21.8	8.0	2001-000042	R-CARBON	1Kohm,5%,1/4W,AA,TP,2.4x6.4mm	
R230	60.0	109.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R231	45.0	42.0	2001-000053	R-CARBON	3.3Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R232	38.5	18.0	2001-000053	R-CARBON	3.3Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R233	51.3	25.3	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R234	54.0	109.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
R235	41.0	18.0	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R236	56.5	109.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R237	29.5	63.5	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R238	43.5	18.0	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R240	62.5	109.3	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R241	29.5	43.5	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R242	29.5	46.0	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R243	29.5	52.0	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R244	30.5	73.3	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R245	30.5	70.5	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R246	30.5	76.0	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R247	29.5	49.5	2001-000035	R-CARBON	220ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R256	89.0	47.0	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R257	222.5	104.5	2001-000553	R-CARBON	270ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R258	93.0	101.0	2001-000553	R-CARBON	270ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R259	93.0	96.0	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R260	247.3	109.5	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R262	74.8	67.0	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R264	38.8	32.0	2001-000652	R-CARBON	330ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R266	40.3	114.5	2001-000053	R-CARBON	3.3Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R270	60.5	43.0	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R301	141.8	91.3	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R302	93.0	89.5	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R305	92.3	68.0	2001-000059	REF-CF,5.6K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R306	92.3	70.5	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R309	125.5	35.5	2001-000245	REF-CF,1.5,5%,1/2W	350V,-350 TO +350PPM/C,R-AXIAL	
R310	131.8	62.8	2001-000037	R-CARBON(S)	330ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R311	120.8	55.0	2004-001022	REF-MF,5.6K,1%,1/4W	250V,-100 TO +100PPM/C,R-AXIAL	
R312	123.5	73.8	2004-004230	R-METAL	0.9ohm,5%,1/2W,AA,TP,3.3x9mm	
R313	101.5	59.5	2004-000284	R-METAL	12Kohm,1%,1/4W,AA,TP,2.4x6.4mm	
R314	102.5	42.8	2004-000679	R-METAL	2Kohm,1%,1/4W,AA,TP,2.4x6.4mm	
R315	102.5	46.3	2004-000284	R-METAL	12Kohm,1%,1/4W,AA,TP,2.4x6.4mm	
R316			2001-000075	R-CARBON	39Kohm,5%,1/8W,AA,TP,1.8x3.2mm	TILT OPTION
R317			2001-000067	R-CARBON	10Kohm,5%,1/8W(1/6W),AA,TP,1.8	TILT OPTION
R318			2001-000043	R-CARBON	1Kohm,5%,1/8W,AA,TP,1.8x3.2mm	TILT OPTION
R319			2001-000064	R-CARBON	7.5Kohm,5%,1/8W,AA,TP,1.8x3.2m	TILT OPTION
R320	101.0	17.0	BH39-40305U	CBF-HARNESS	52MM,AWG22(0.6PI),MPR-II	TILT OPTION
R321			2001-000083	R-CARBON	82Kohm,5%,1/8W,AA,TP,1.8x3.2mm	TILT OPTION
R322	114.5	92.0	2001-000066	R-CARBON(S)	10Kohm,5%,1/2W,AA,TP,2.4x6.4mm	
R401	185.5	132.8	2001-000072	R-CARBON	22Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R403	30.0	140.5	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	
R404	30.0	147.0	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	
R405	72.0	143.0	2001-000097	R-CARBON	1Mohm,5%,1/6W,AA,TP,1.8x3.2mm	⚠
R406	46.0	134.3	2004-001137	R-METAL	6.8Kohm,1%,1/8W,AA,TP,1.8x3.2m	
R407	81.0	137.5	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R408	55.3	134.3	2001-000048	REF-CF,2.2K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R409	44.5	161.0	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
R410	78.5	178.5	2001-001072	R-CARBON(S)	12ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R411	154.5	224.8	2001-000211	R-CARBON	1ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R412	172.3	232.8	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	
R413	162.3	224.3	2001-000029	R-CARBON	100ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R414	106.0	221.0	2001-000016	R-CARBON(S)	1ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R415	135.5	218.0	2001-000525	R-CARBON	22ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R416	66.5	218.0	2003-000009	R-METAL OXIDE(S)	220ohm,5%,1W,AA,TP,3.3x9mm	
R417	68.3	178.5	2003-000009	REF-CF,220,5%,1/2W(S)	220ohm,5%,1W,AA,TP,3.3x	⚠
R418	58.5	183.5	2001-000404	R-CARBON	180ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R419	63.5	198.5	2001-000043	REF-CF,1K,5%,1/6W	150V,-1300 TO +350PPM,R-AXIAL	
R420	28.0	191.0	2001-000048	REF-CF,2.2K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R421	25.3	191.0	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R422	21.5	217.0	2001-000097	R-CARBON	1Mohm,5%,1/6W,AA,TP,1.8x3.2mm	
R423	9.5	217.0	2001-000097	R-CARBON	1Mohm,5%,1/6W,AA,TP,1.8x3.2mm	
R424	51.0	179.3	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R425	53.5	179.3	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R427	24.3	217.0	2001-000076	REF-CF,47K,5%,1/4W	250V,-600 TO -150PPM/C,R-AXIAL	
R428	12.5	217.0	2001-000076	REF-CF,47K,5%,1/4W	250V,-600 TO -150PPM/C,R-AXIAL	
R430	162.8	114.0	2001-000721	R-CARBON	4.3Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R431	167.8	151.5	2004-000327	R-METAL	150Kohm,1%,1/4W,AA,TP,2.4x6.4m	
R432	77.5	120.8	2001-000089	R-CARBON	150Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R434	165.5	101.8	2001-000496	R-CARBON	20Kohm,5%,1/6W,AA,TP,1.8x3.2mm	15”
R434			2001-000367	R-CARBON	15Kohm,5%,1/8W,AA,TP,1.8x3.2mm	14”
R435	160.8	141.5	2001-000053	R-CARBON	3.3Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R437	55.5	161.0	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R438	74.0	114.3	2001-000083	R-CARBON	82Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R439	16.5	88.8	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R440	16.5	91.3	2001-000868	R-CARBON	56ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R442	78.0	143.0	2001-000086	R-CARBON	100Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R443	74.0	154.8	2001-000547	R-CARBON	270Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R444	165.3	141.5	2001-000836	R-CARBON	51Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R445	96.0	131.3	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R502	92.5	164.3	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R503	81.5	160.0	2001-000644	R-CARBON	330Kohm,5%,1/6W,AA,TP,1.8x3.2m	⚠
R504	204.5	235.3	2001-000496	R-CARBON	20Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R505	207.0	227.3	2001-000034	R-CARBON	220ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R506	96.3	161.5	2001-000688	R-CARBON	390Kohm,5%,1/6W,AA,TP,1.8x3.2m	⚠
R507	81.0	140.0	2001-000075	R-CARBON	39Kohm,5%,1/6W,AA,TP,1.8x3.2mm	⚠
R508	96.3	153.5	2004-000284	R-METAL	12Kohm,1%,1/4W,AA,TP,2.4x6.4mm	⚠
R509	82.5	177.5	2004-004095	R-METAL	2.36Kohm,1%,1/4W,AA,TP,2.4x6.4	15” ⚠
R509			2004-004233	R-METAL	2.46Kohm,1%,1/4W,AA,TP,2.4x6.4	14” ⚠
R510	191.8	231.0	2001-000836	R-CARBON	51Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R511	219.3	209.0	2001-000057	REF-CF,5.1K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R512	180.3	144.0	2001-003116	R-CARBON	360Kohm,5%,1/6W,AA,TP,1.8x3.2m	15”
R512			2001-000094	R-CARBON	560Kohm,5%,1/8W,AA,TP,1.8x3.2m	14”
R513	217.5	180.0	2001-000016	R-CARBON(S)	1ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R514	199.5	235.3	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	

Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
R515	142.5	107.5	2001-000889	REF-CF,6.8K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R516	225.8	174.8	2001-000644	R-CARBON	330Kohm,5%,1/6W,AA,TP,1.8x3.2m	15”
R516			2001-000090	R-CARBON	180Kohm,5%,1/8W,AA,TP,1.8x3.2m	14”
R517	85.0	39.0	2001-000104	R-CARBON	1.2Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R518	212.8	211.5	2001-000090	R-CARBON	180Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R519	77.0	42.0	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R520	180.3	141.5	2001-000084	R-CARBON	100Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R521	207.5	156.5	2001-000107	R-CARBON(S)	150Kohm,5%,1/2W,AA,TP,2.4x6.4m	
R522	206.5	160.8	2001-000096	R-CARBON(S)	1Mohm,5%,1/2W,AA,TP,2.4x6.4mm	
R523	216.0	218.0	2001-000688	R-CARBON	390Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R524	216.0	215.5	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R525	212.8	135.3	2001-000100	R-CARBON	2.2Mohm,5%,1/6W,AA,TP,1.8x3.2m	
R527	105.0	178.3	2001-001099	REF-CF,2.7K,5%,1/2W(S)	300V,-200 TO +200PPM/C,R-AXIAL	
R529	109.5	178.3	2001-000110	REF-CF,10,5%,1/4W	250V,-350 TO +350PPM/C,R-AXIAL	
R530	98.5	131.3	2001-003135	R-CARBON(S)	0.47ohm,5%,1/2W,AA,TP,2.4x6.4m	
R531	125.5	147.5	2001-001197	R-CARBON(S)	910ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R532	223.3	174.8	2001-000531	R-CARBON	240Kohm,5%,1/8W,AA,TP,1.8x3.2m	15”
R532			2001-000093	R-CARBON	470Kohm,5%,1/8W,AA,TP,1.8x3.2m	14”
R534	74.0	157.3	2001-000097	R-CARBON	1Mohm,5%,1/6W,AA,TP,1.8x3.2mm	
R536	190.0	130.0	2001-000048	REF-CF,2.2K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R537	190.0	127.5	2001-000053	R-CARBON	3.3Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R539	201.3	122.5	2001-000069	R-CARBON	12Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R540	190.0	132.5	2001-000069	R-CARBON	12Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R542	219.8	144.8	2001-000064	R-CARBON	7.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R543	178.5	138.5	2001-000074	R-CARBON	33Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R544	102.5	102.0	2001-000051	R-CARBON	2.7Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R546	181.8	228.5	2001-000067	REF-CF,10K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R602	277.3	114.5	2001-000027	R-CARBON	100ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R603	267.3	114.3	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R604	184.8	18.3	2001-000111	R-CARBON	150ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R605	172.0	9.0	2004-001060	R-METAL	51Kohm,1%,1/4W,AA,TP,2.4x6.4mm	
R606	195.8	12.5	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R607	175.0	9.0	2001-000889	REF-CF,6.8K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	⚠
R609	178.0	9.0	2004-004095	R-METAL	2.36Kohm,1%,1/4W,AA,TP,2.4x6.4	⚠
R611	174.5	87.0	2001-000790	R-CARBON	47ohm,5%,1/2W,AA,TP,3.3x9mm	⚠
R612	253.0	13.8	2003-000704	R-METAL OXIDE(S)	47Kohm,5%,1W,AA,TP,3.3x9mm	
R613	167.8	53.8	2001-000432	R-CARBON	1Mohm,5%,1/4W,AA,TP,2.4x6.4mm	
R614	284.8	13.8	2001-000642	REF-CF,330K,5%,1/2W	350V,-600 TO -150PPM/C,R-AXIAL	
R615	247.5	53.3	2001-000374	R-CARBON	15ohm,5%,1/4W,AA,TP,2.4x6.4mm	
R616	271.5	68.3	2003-000738	R-METAL OXIDE(S)	56Kohm,5%,2W,AA,TP,4x12mm	
R617	26.5	176.3	2001-000105	R-CARBON	1.5Kohm,5%,1/4W,AA,TP,2.4x6.4m	
R618	257.5	40.8	2003-000010	REF-MO,8.2K,5%,3W(S)	350V,-350 TO +350PPM/C,R-AXIAL	
R619	39.3	187.5	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R620	198.8	92.5	2003-000428	R-METAL OXIDE(S)	1.5Kohm,5%,1W,AA,TP,3.3x9mm	
R621	147.3	78.0	2001-000056	REF-CF,4.7K,5%,1/6W	150V,-1300 TO +350PPM/C,R-AXIAL	
R622	220.3	77.3	2001-001163	R-CARBON(S)	560ohm,5%,1/2W,AA,TP,2.4x6.4mm	
R623	142.8	60.3	2001-000856	R-CARBON	560ohm,5%,1/6W,AA,TP,1.8x3.2mm	

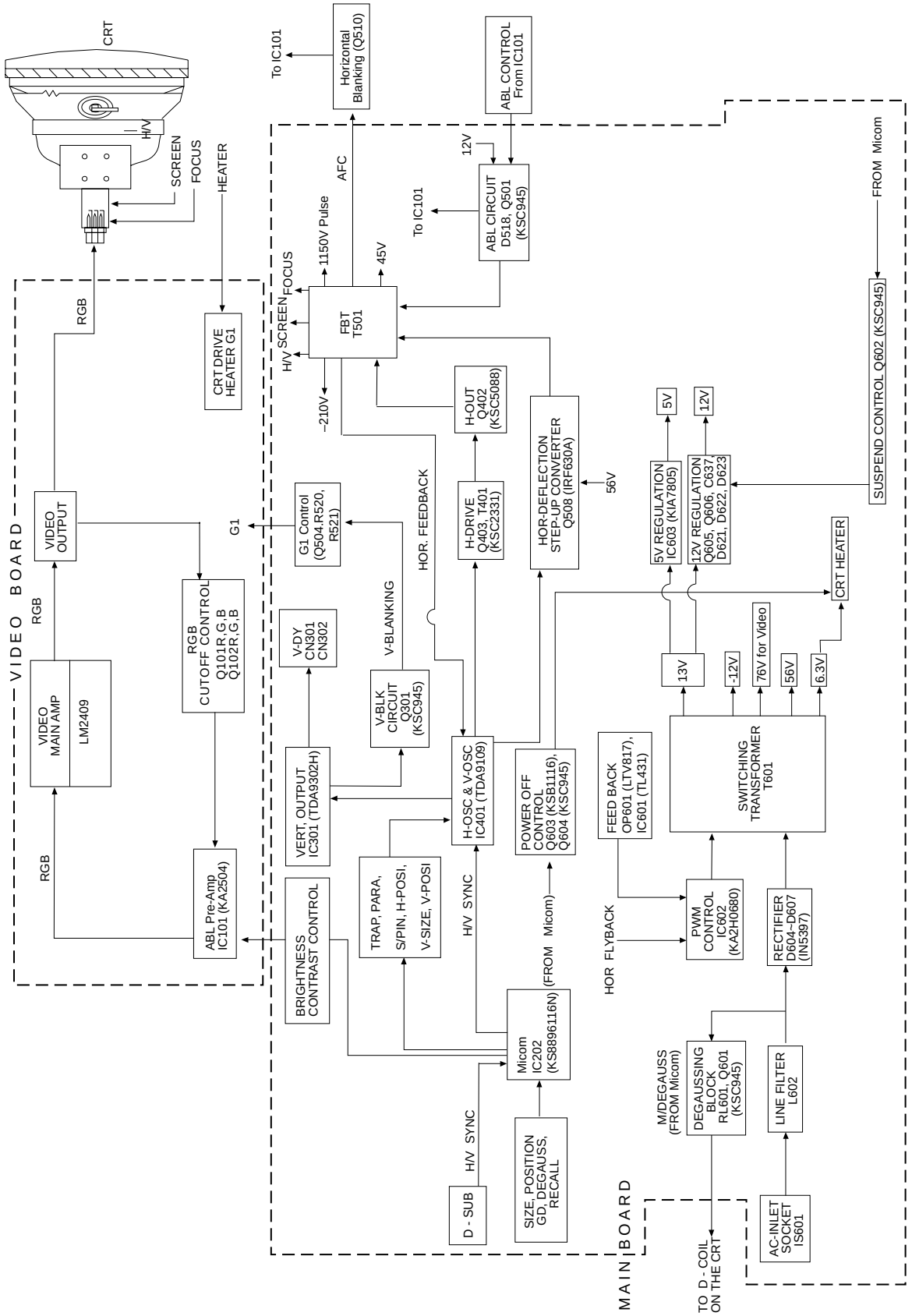
Loc. No.	Coordinates (X,Y)		Code No.	Description	Specification	Remarks
R624	142.8	67.5	2001-000077	R-CARBON	47Kohm,5%,1/6W,AA,TP,1.8x3.2mm	
R625	149.8	70.0	2001-000856	R-CARBON	560ohm,5%,1/6W,AA,TP,1.8x3.2mm	
R626	195.8	15.0	2001-000106	R-CARBON	1.5Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R627	264.5	153.0	2001-000054	R-CARBON	3.9Kohm,5%,1/6W,AA,TP,1.8x3.2m	
R628			2001-000043	R-CARBON	1Kohm,5%,1/8W,AA,TP,1.8x3.2mm	M/M Option
R629			2001-000043	R-CARBON	1Kohm,5%,1/8W,AA,TP,1.8x3.2mm	M/M Option
R630			2001-000067	R-CARBON	10Kohm,5%,1/8W(1/6W),AA,TP,1.8	M/M Option
R631			2001-003135	R-CARBON(S)	0.47ohm,5%,1/2W,AA,TP,2.4x6.	
RL601	286.3	85.0	3501-000266	RELAY-POWER	12V,720m/W,5A,2FormA,3mS	
RL602	290.0	106.3	3501-001111	RELAY-POWER	12Vdc,250mW,5A,1FormA,15mS,5mS	
SK101	304.8	159.0	4715-000001	SURGE ABSORBER	1KV,+50-10%	
SK102	281.5	171.3	4715-000106	SURGE ABSORBER	300V,CHIP	
SK103	295.0	178.5	3704-001014	SOCKET-CRT	12P,22.5PI,26.5PI,SN	
SW201	7.0	189.5	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW202	7.0	175.5	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW203	7.0	161.5	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW204	7.0	147.5	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW205	7.0	104.4	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW206	7.0	90.4	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW207	7.0	76.4	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW208	7.0	62.4	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW209	7.0	120.2	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW210	7.0	131.7	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
SW211	7.0	20.0	3404-000244	SWITCH-TACT,7.3X7.1X4	12V,50MA,SPST,160G,MECHANIC	
T401	91.8	183.3	BH26-30336A	TRANS-HOR.DRIVE	9.6MH,6P,EE2017,SB-5S,9.6MH/10	⚠
T501	188.0	181.0	BH26-10335Y	TRANS-FBT	flyback transformer	⚠
T601	217.5	26.5	BH26-20336E	TRANS-POWER (S/W)	430uH/130uH,16P,EER3541,PL3,7.	
T602	210.8	79.5	BH26-30302S	TRANS-SYNC.	3-1(250UH),SB-5S,UU1116,3-	
TH601	263.5	95.5	1404-000002	THERMISTOR-NTC	NTC,9OHM,20%	
TH602	271.3	77.8	1404-001020	THERMISTOR-NTC	8ohm,15%,17mW/C,BK	
VR502	167.0	237.5	2103-000493	VR-SEMI	5Kohm,30%,1/10W,SIDE	
X201	47.5	68.8	2801-000005	CRYSTAL-UNIT	8MHz,50ppm,28-AAM,S,35ohm,TP	

Others

Loc. No.	Code No.	Description	Specification	Remarks
⚠ CRT	BH03-10338J	CRT-COLOR	14,0.28,M34QBH351X122,SINGLE	
	BH03-10338P	CRT-COLOR	14,0.28,M34QBH351X122(M)	
	BH03-10341L	CRT-COLOR	14,0.28,M34QBH351X122(R/LP)	
	BH03-10337W	CRT-COLOR	15,0.28,M36KUK35X02(E/LP)	
	BH03-10338S	CRT-COLOR	15,0.28,M36KUK35X02(R/E/LP)	
	BH03-10338R	CRT-COLOR	15,0.28,M36KUK35X02(M/E/LP)	
	BH03-10337X	CRT-COLOR	15,0.28,M36KUK35X02(T4/LP)	
D-COIL	BH27-10336B	COIL-DEGAUSSING	360*240*1060MM,7.2MH,22.5OHM	
	BH27-10336C	COIL-DEGAUSSING	290*200*980MM,6.5MH,20.3OHM,85	
PROCESS-PBA UNIT	BH94-30016L	ASSY,PCB	CHA4217BR2/BRD,SEDA,BRAZIL	
	BH94-30016M	ASSY,PCB	CHA4217KR1/KRS,KOREA	
	BH94-30014X	ASSY,PCB	CHA4217L1B,SEASA,ARGENTINA	
	BH94-30016S	ASSY,PCB	CHA4217L,SEAO,KAZAKHSTAN	
	BH94-30017M	ASSY,PCB	CHA4227L,EDC,EUROPE	
	BH94-30016Q	ASSY,PCB	CHA5807BR2/BRD,SEDA,BRAZIL	
	BH94-30016P	ASSY,PCB	CHA5807KR1/KRS,KOREA	
	BH94-30017N	ASSY,PCB	CHA5227L1A,EDC,EUROPE	
	BH94-30017T	ASSY,PCB	CHA5227T,EDC,EUROPE	
	BH94-30014Y	ASSY,PCB	CHA5807L1B,SEASA,ARGENTINA	
	BH94-30016T	ASSY,PCB	CHA5807L,SEAO,KAZAKHSTAN	
B/D ASS'Y CODE	BH98-10014L	ASSY,PCB/MAIN	CHA4217L1B,SEASA,ARGENTINA	
	BH98-10015Y	ASSY,PCB/MAIN	CHA4217L,SEAO,KAZAKHSTAN	
	BH98-10016R	ASSY,PCB/MAIN	CHA4227L,EDC,EUROPE	
	BH98-10016S	ASSY,PCB/MAIN	CHA5227L1A,EDC,EUROPE	
	BH98-10016W	ASSY,PCB/MAIN	CHA5227T,EDC,EUROPE	
	BH98-10014M	ASSY,PCB/MAIN	CHA5807L1B,SEASA,ARGENTINA	
	BH98-10015Z	ASSY,PCB/MAIN	CHA5807L1A,SEAO,KZAZKHSTAN	
P/CORD	BH39-10007A	CBF-POWER/CORD	DET,H05VV-F,250V/6A,IVY,1830MM	
	BH39-10339E	CBF-POWER/CORD	DET,SVT,125V 7A/10A,IVORY,1830MM	
SIGNAL CABLE	BH39-20337S	CBF-SIGNAL	ATT,1200MM,15P/13P,IVORY,UL296	

Memo

10 Block Diagram



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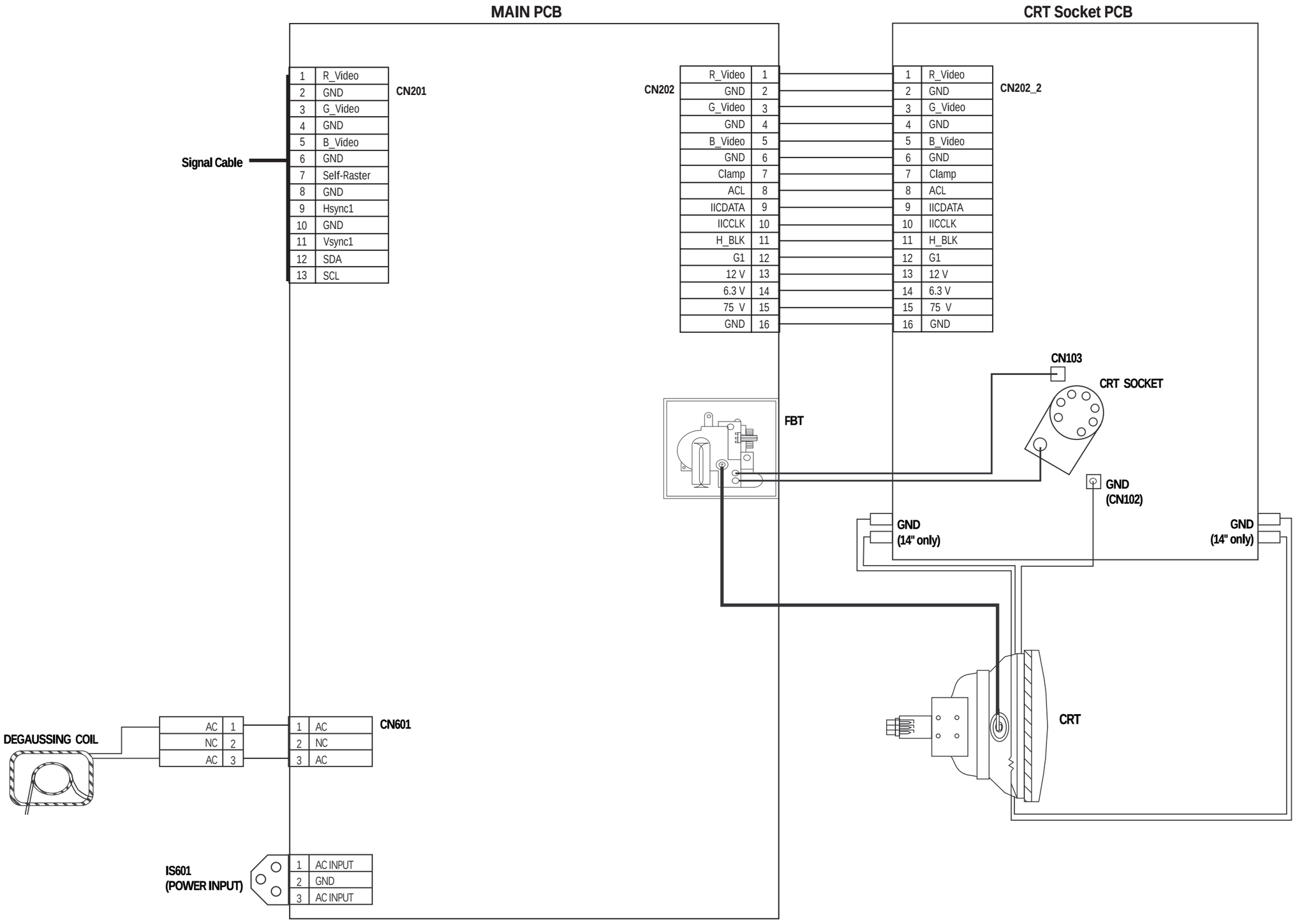
12 Wiring Diagram